# GAS JOURNAL, JULY 31, 1940

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## EDITORIAL NOTES

### SCIENCE AND PROGRESS

AT the annual meeting of the Society of Chemical Industry this month Lord Samuel was awarded the Messel Medal and delivered a Lecture in philosophic vein on the subject of science and civilization. It is, of course, a subject which calls for deep thinking, and over the years much discussion has been centred on it. The question asked is whether scientists are pioneers in an upward march of mankind towards greater well-being or whether in fact their work is misguided and may lead to ultimate destruction. In the present time of turmoil and war some may hold the latter view. The combination of science and industry has let loose a "whole tribe of subtle devils of destruction." But said Lord Samuel, imagine modern physical science wiped out. All the diseases that have been struck out of the catalogue of human ills would return again; surgery would be crude and agonizing; the abundance which is within our grasp would fade away. It is no empty service that industrial science renders in making accessible to everyone commodities and amenities which in an earlier age were undreamed of. As chemistry and physics and engineering advance, the perversion of their discoveries to the uses of war becomes more and more deadly. But that is not the fault of the scientist; most of the inventions employed in war were originated for blameless purposes of peace. Disposing of hasty judgment, Lord Samuel concluded: While recognizing that it should seek no monopoly in our activities, or even predominance, science, vindicated in its purposes, may rightly ask from society as a whole the conditions that will best develop its efficiency and ensure its success in tasks that are beneficial and indispensable.

It certainly is a melancholy reflection that the knowledge and skill which have gone to the building up of science and its application for the benefit of mankind can be perverted for the purposes of destruction on the largest scale. It is with materials and machines discovered, designed, and produced by the chemist and the engineer that whole towns are laid in ruins and peaceable folk sent to their death. But, in common with Lord Samuel, Professor Philip, in his Address as President of the Society at the same meeting, expressed the opinion that it is a wholly superficial view which holds science especially responsible for the prostitution of its resources to destructive ends. The misuse of discoveries and inventions must not be allowed to obscure their beneficial effects. The Gas Industry is not a wicked industry because it is a source of high explosives. Science can make no provision for moral values; and, as Lord Samuel observed, we cannot leave Justice with only her ancient sword to face Injustice armed with machine gun and grenades.

### SULPHATE OF AMMONIA

IN the "JOURNAL" of July 17 we referred to the Sulphate of Ammonia (Charges) (No. 1) Order made by the Treasury. This gave the Treasury power to recover charges incurred in the scheme of control. Producers of sulphate must recoup the Treasury on all deliveries of 2 cwt. or over of the material for use as fertilizer sums ranging from £1 2s. 9d. per ton for quantities of six tons or more, to £2 2s. 9d. for deliveries under a ton. When the approval of the Order was made in the House of Commons, Mr. Harold Macmillan, Parliamentary Secretary to the Ministry of Supply, explained that before the war home-produced sulphate was sold through the British Sulphate of Ammonia Federation at a uniform price without regard to distance from the source of production. Since the war the price has been fixed, not by the Federation, but by the Ministry of Supply; and the new Order secures that the uniform delivery price shall continue. It may now be necessary to send the sulphate longer distances. It is intended to retain the uniform delivery price, and by arrangement between the Ministry of Agriculture and the Ministry of Supply the machinery laid down in the Order is for that purpose. In calculating the sum to be levied regard was had to freight and what may be called a contingency reserve.

Since the war the cost of imported acid-making material and other costs have risen to a greater extent in that part of the industry which is based upon by-product recovery than in that part which is based upon atmospheric nitrogen. The synthetic makers do not wish to make an additional profit out of the revised price and have agreed voluntarily to surrender any additional profit accruing to them. That extra profit will be put into the fund to reduce the price accordingly.

### GAS CENTRAL HEATING

TO-DAY we publish descriptions of a number of gas-fired central heating installations lately completed or in course of completion in the Croydon area—a Company which has gone out for the central heating load. These installations are of interest not by reason of any revolutionary design or application, but rather because they represent a growing "gas-consciousness" among those who require large-scale heating at a minimum of trouble and expense. Such installations, coming in a time of National emergency, bear eloquent testimony to the reliance which is placed in our fuel and foreshadow the greatly extended central heating load to which the Industry may confidently look forward in the future provided a progressive tariff scale is offered.

The installations cited in this week's "JOURNAL" are typical examples of the widely differing systems and buildings to which they can be applied. In one case it is a hospital; in others extensions to factory buildings—each type employing different methods of circulation and in certain instances replacing solid fuel systems. The principal reasons for growth in gas central heating are not far to seek. They are, first, a growing appreciation of the need for automatic, efficient, and trouble-free service which dispenses with the employment of a stoker or other attendant, and the labour involved in delivering fuel, at a time when our man-power is urgently required for more important duties. Secondly, a clean, smokeless fuel, the use of which releases by-products which are essential to the prosecution of the war, is being accepted as being in the National interests. Allied to these reasons is the important question of fuel storage—often overlooked in comparing the costs of different systems. To place this item in its proper perspective, however, it may be observed that cellarage for, say, 500 tons of coal or coke would involve capital expenditure of some £1,000 for building work.

Ever since the outbreak of hostilities—and long before that—we have pointed in the columns of the "JOURNAL" to the particular adaptability of gas to water heating for A.R.P. and other purposes associated with our war effort. But in considering the wide variety of applications to which the smaller "unit" heater is being put we must not overlook the many larger central heating and hot water supply installations which have been taking shape in the meantime, serving the needs of vital industries, hospitals, educational, and other establishments in every part of the country.

### TIMBER CONTROL TIGHTENED UP

ALTHOUGH the Gas Industry is not one of the major timber-using industries its many requirements in the way of purifier, washer, and scrubber grids, concrete shuttering, excavation shoring, meter shelving, and other items are affected by the timber control regulations which have recently been tightened up to meet the changing circumstances of the war. On the outbreak of hostilities the whole of the imported timber available for sale in this country consisted of the private stocks in

the hands of importers and merchants. Since September all importations, with certain minor exceptions, have been made by the Timber Control of the Ministry of Supply in accordance with the Government policy of centralized purchase of essential materials. Changing conditions have necessitated the issue of many more control orders in respect of timber than have been made, for example, in regard to iron and steel, and the trade is now governed by the Control of Timber (No. 13) Order, which came into operation on July 1.

Under this Order no timber, other than small lots not exceeding £1 in value in a month, may be acquired or disposed of except under licence or by special or general directions issued by the Ministry of Supply. The Order, which, with its five schedules, comprises a 108 octavo page book, sold at 2s. 6d. by the Stationery Office (S.R. and O., 1940, No. 1098) imposes a rigid control of prices, but excludes from price regulation the sale or purchase of unpeeled logs produced from wood from France or Portugal, commonly known in the South Wales coal trade as "pitwood." A Direction made under the Order states that such logs which have been imported through a port in Monmouth, Glamorgan, Pembroke, Carmarthen, or Brecon may without licence be acquired and used in any coal mine in any of those counties on such terms and conditions as may be agreed, with the approval of the Ministry of Supply.

Direction No. 1 of the Order provides, *inter alia*, that timber acquired before Oct. 4, 1939, may be used without licence for the maintenance or renewal of railway works or equipment necessary for the operation of essential transport services, the repair or renewal of railway wagons to be used in the United Kingdom, and by public utility undertakings for urgent repair work. The maximum limits for consumption by other consumers from their own stocks without licence are reduced to one standard for softwood, 100 cu.ft. for hardwood, 1 cu.m. or ten bundles (whichever is the less) for plywood and veneer.

Earlier Orders provided for acquisition and disposal of timber without licence up to a value of £5 per month for work of national importance or urgent necessity by holders of forms known as "O.A." and "O.C." (old acquisition and old consumption licences). These forms are now abolished and all acquisitions of timber are now subject to licence, except small £1 lots once a month. Transactions between merchants will in future be subject to licence. In short, subject to the exemptions from the consumer's licence requirements in the cases referred to and to the existing exemptions from that requirement in the case of Government Departments and certain essential services, the Order extends the licensing system to all transactions in both imported and home-grown timber. The £2 limit of exemption from price control is now reduced to £1.

Increased prices for imported timber are fixed by the Order, which does not, however, alter the prices of home-grown timber or of plywood. A special arrangement has been made, with the agreement of the coal industry, in respect of imported mining timber. The cost to the Timber Control of imported pit props is very much greater than the price of home-grown props, but in order to avoid large differences in the cost of timber to different mines prices for imported props are fixed at a figure near, though still higher than, the price of home-grown props. The resultant loss to the Timber Control will be recovered by a levy, at the rate of 4d. per ton on sales of coal. This special arrangement does not apply for the time being to South Wales mines, which use pitwood that they themselves import.

## Gas-Works Fuel Houses

The Oldham Corporation Gas Department have proceeded far indeed on the road of promotional tariffs, and even with the addition of the all-round increase of 6d. per 1,000 cu.ft. which rising costs made it necessary to impose as from the final meter reading in the last December quarter, the rates quoted remain really attractive. One of these rates refers to "Gas-works fuel houses," under which classification consumers may either take advantage of the two-part tariff, with a further reduction of 5% from the current coke prices, or adopt the domestic scale, with an additional discount of 5% and a similar discount from current coke prices. To secure the advantages of this scheme, an arrangement with the Corporation has to be signed by the householder. The two-part tariff, under the revised gas price, comprises a commodity charge of £2 per annum per house (paid quarterly), and gas at 2s. 9d. per 1,000 cu.ft., less 6d. per 1,000 cu.ft. discount. For furnace consumers prices range (according to consumption) from 3s. 1d. per 1,000 cu.ft., less 6d. discount, to 2s. 8d., while for gas engine users the price for largest consumption falls to 2s. 4d., with the same discount. Where a baker's oven (externally heated) is installed the gas consumed is charged for at 2s. per 1,000 cu.ft. net; while in the case of a gas-fired boiler for central heating or steam raising purposes, 1s. 10d. per 1,000 cu.ft. net is charged. In all instances in which the consumption in industrial establishments reaches 4½ millions a quarter, the consumption will be charged at rates varying from 2s. 2d. per 1,000 cu.ft. net down to 1s. 10d. The charge to private consumers, also, varies according to consumption.

## Benzole Recovery

Peacetime practice required that a gas undertaking wishing to alter its declared calorific value should give to the Board of Trade three months' notice of this intention. Benzole is now urgently needed for the prosecution of the war. Often benzole recovery may make it desirable for an undertaking to re-declare the calorific value of the gas supplied. This three months' notice is now no longer demanded. The procedure is for the undertaking to apply to the Board of Trade for permission to modify the C.V. consequent upon benzole recovery. The permission granted, then the undertaking can commence to operate the benzole plant at any time and send out gas at a different calorific value.

## Exterior Lighting

As being indicative of the excellent lighting service which modern gas equipment can give, we call attention to an article in the "JOURNAL" to-day referring to the gas installation at the Preston Station of the London, Midland, and Scottish Railway Company, where the lighting is centrally controlled. A distant control system is employed for controlling exterior lighting on the same mains as indoor lighting and cooking. Two control valves were adjusted so that the main supply to the burner—there are about 250 lamps—was shut off at a pressure of 1.4 in. W.G. With this pressure, however, indoor lighting units function satisfactorily, and cooking can proceed, though, of course, at a reduced rate. The normal pressure is 3 in. W.G. Reduction to 1.4 in. extinguishes the outside lamps within two or three seconds. The article demonstrates how well adapted gas lighting is for distant control.

# Personal

On Friday last the Directors of the Brighton, Hove and Worthing Gas Company appointed their General Manager, Mr. P. E. BROWNE, Managing Director of the Company. He has been associated with the Brighton Company for a number of years, and those who attended the last Conference of the B.C.G.A. will have sampled Mr. Browne's genius for management, as he it was who was responsible for arranging those very pleasant hours at Brighton and the neighbourhood culminating in the visit to Glyndebourne.

# Obituary

The funeral took place on July 24 at Witton Cemetery, Birmingham, of Mr. DONALD A. JAPES, Secretary of John Wright & Co., Ltd., whose death on the previous Thursday, after only a few days' illness, has cut short a career which seemed full of promise. Mr. Japes, who was in his thirty-fourth year and unmarried came to Birmingham about two and a half years ago. He began his business career in the Chief Accountant's Department of the Great Western Railway; from there he joined the staff of Radiation, Ltd., in London, some twelve years ago. An all-round athlete, Mr. Japes was keenly interested in Rugby football, and played regularly until recently. In the comparatively short period of his residence in Birmingham, his sincerity and attractive personality had made for him a wide circle of close friends. He brought tremendous enthusiasm to bear in all his many duties, and still found time to devote many hours to the social activities of the Company's Sports Club, Defence Corps, &c. Mr. Japes had recently been appointed Secretary to the Gas Appliance Manufacturers Export Group.

A large attendance at the cemetery included Mr. Arthur Japes (father), Mr. and Mrs. Ernest Japes and Mr. and Mrs. Sidney Japes, Mr. J. F. Davies and Miss Kathleen Davies, Mr. Ivan Yates, Mr. F. A. Hooper, Mr. L. P. Potter, Mr. T. N. Jennings, Mr. and Mrs. B. E. Martin, Mr. and Mrs. D. P. Shearer, Mr. R. J. Rogers, Mr. E. M. Ketteringham, Mr. T. Thrutchley Tripp, Mr. A. A. O'Sullivan, Mr. A. A. Miller, Dr. F. C. Gould, Mr. Reginald Wilson, Mr. Edward Hill, Mr. Robin Evans, Mr. and Mrs. Thibault, and many others. Among the many beautiful floral tributes were represented the various activities in which Mr. Japes had been interested in a short but most useful life.

## NEWS OF THE WEEK

**First Prize** for the best advertising display in the recent Stockport Charity Carnival was awarded to the Gas Department.

**Hawick Gas Company, Ltd.,** has raised the price of gas by 2½d. per 1,000 cu.ft., making the new price 4s. 2d. per 1,000 cu.ft.

**Thirty Motor Vehicles** in the Wallasey district are now operated on compressed town gas. Twelve of these are owned by the Wallasey Corporation.

**The Following British Standard Specification** can be obtained on application to the Secretary of the Institution of Gas Engineers, 1, Grosvenor Place, S.W.1, price 2s. each, post free : No. 914-1940. Tests for Laboratory Porcelain.

**The Tennis Courts** of Dolphin Square, London's largest block of flats, have been buried beneath a thousand tons of coke. The courts were sacrificed to meet the Government's appeal to lay in fuel stocks in order to help the mining industry.

**The Closing of their Showrooms** for the duration of the war was considered at a recent meeting of the Leicester Gas Committee, but after discussion it was decided to make no change in the present policy. The Committee came to the conclusion that it is in the interests of both consumers and Gas Department to keep open the showrooms at Syston, Belgrave, Braunstone Gate, and Humberstone.

## Classes for Canteen Workers

### All-Gas Equipment

Believed to be the first school in the country for training canteen workers, the Wimbledon Technical College has inaugurated special classes in large-scale catering.

While the existing domestic science classroom at the College includes both gas and electric cookers, it is of interest to note that the larger equipment in the new section devoted to canteen cookery is all gas. Fitted up by the Wandsworth & District Gas Company, the apparatus consists of a double-oven "New World" range, "Savoy" grill, a Richmonds hotplate, Fletcher Russell steamer, and Stott tea and coffee set. It is noteworthy that gas is regarded as the best equipment on which to teach large-scale catering.

Commenting upon this new step, the teacher in charge explained that the course had been arranged because of an anticipated big increase in communal feeding in the future. Canteen cooking being very different from ordinary cooking, the facilities provided at this College would give the workers a proper chance to master the job.

The apparatus in the existing domestic science room at the Wimbledon Technical College includes the latest types of gas cooker, including models by Cannon, Main, and Radiation.

## Gas Undertakings Results

### Dunfermline

The quantity of gas made per station by the City and Royal Burgh of Dunfermline during the twelve months ended May 15 was 416,978,000 cu.ft., which, when compared with the make of the preceding year, represents a decrease of 27,230,000 cu.ft., or 6.13%; while the amount accounted for decreased by 30,115,000 cu.ft., or 7.32%. Sales of gas appliances in the showroom show an increase of £1,300 over those of the previous year, a very satisfactory result in the circumstances. The outbreak of war, and the consequent complete stoppage of street lighting, together with the closing down of works using large quantities of gas, caused a heavy decrease in output for a few months. Other demands, however, arose during the remainder of the year which greatly reduced these losses. The present scale of charges for gas ranges from 3s. 4d. per 1,000 cu.ft. for small consumptions to 1s. 9d. for large quantities, and as it has been decided that there will be no increase in these prices, an increase in sales is hoped for such as may wipe out at least a part of the loss in output experienced in the past year. There is a surplus on the year's working of £677, to which is added a balance brought forward of £592. After transferring £750 to Retort Reserve Fund, there will remain to be carried forward the sum of £519.

### Leicester

The quantity of gas sold by the City of Leicester Gas Department during the year to March 31 was 2,489,912,053 cu.ft., which compares with a total of 2,557,260,152 cu.ft. in the preceding twelve months. The accounts show that the balance carried to Net Revenue Account on the present occasion is £86,973, as against £69,602 a year ago; receipts from the sale of gas having amounted to £444,021, compared with £423,487 a year ago. Net receipts from residual products are up from £72,879 to £79,188. Net revenue, being surplus for the year, is £2.006, as against a deficiency for the twelve months to March, 1939, of £17,374.

## Centralized Control of Gas Lighting at Preston Station

### A Contribution from the Lighting Section of the L.M.S. Railway

It is a condition of the Police when granting exemption under the Lighting (Restrictions) Order, 1940, that the agreed exterior lighting must be capable of being immediately extinguished upon receipt of the appropriate instructions. Gas lighting engineers who have had to deal with this requirement have no doubt experienced the inconvenience and expense of providing separate mains for indoor lighting and cooking when employing the Sugg Distant Control System for the control of the exterior lighting. It is thought the method successfully employed by the L.M.S. Railway utilizing the Sugg D.C. system for controlling exterior lighting on the same mains as indoor lighting and cooking will be of interest.

At Preston Station the peacetime scheme of lighting provided for 42 sectional controls so that the exterior lighting on the platforms and stairways could be lighted or extinguished as traffic required. To extinguish rapidly the exterior lighting from this number of sectional controls would have been impracticable. A scheme of centralized control was, therefore, devised which would enable the exterior lighting to be turned off and on for A.R.P. purposes from two convenient points without extinguishing the interior lighting or the apparatus used by the refreshments department and messrooms and, at the same time, leaving the sectional controls to function for ordinary use.

The exterior lighting which it was desired to control comprised some 200 lamps on No. 1 Control and 56 on No. 2 Control. Most of the lamps were Rochester lamps with hexagonal opal dispersive reflectors and were already fitted with the Sugg Distant Control Valve to operate in conjunction with the sectional control cocks mentioned above. It was necessary to obscure the opal glass to prevent upward light and reduce the superheaters from either four or six lights to one or two mantles.

It was found by experiment that the minimum pressure at which the apparatus used by the refreshments department and messrooms, would reliably operate was about 1.4 in. w.g. This pressure, therefore, decided the extinguishing pressure for the controlled lamps.

The Distant Control Valves were adjusted so that the main gas supply to the burner was shut off at a pressure slightly in excess of 1.4 in. w.g.

The whole of the installation was carried out by the Preston Gas Company to the requirements of Mr. W. K. Wallace, Chief Engineer of the L.M.S. Railway, under the direction of Mr. H. G. Hills.

## Communal Feeding for Munition Workers

So great has been the demand for the Industrial Welfare Society's booklet, "Canteens in Industry," that a third edition has now been published. This edition appears at a particularly opportune moment when the provision of communal feeding facilities has been brought to the fore by the work of the new Factory and Welfare Advisory Board of the Ministry of Labour.

In maintaining the steady flow of munitions the health of the industrial worker is of the utmost importance and the provision of nourishing meals in attractive surroundings essential. Many books have been compiled recently on menus and feeding generally, but few deal with the vital preliminary work of planning and equipping premises, or the problems of management once the canteen is established. The Industrial Welfare Society's booklet, which is based on the experience of hundreds of firms of all types and sizes throughout the country, supplies this information, and therefore fills an important need. Obviously only the outlines of the subject can be given in 70 pages of text, but supplementary sources of information are indicated.

With the appearance of a new edition opportunity has been taken to go through the whole text most carefully, and many additions have been made. Special attention has been given to the problems raised by rationing, by the needs to provide meals for both day and night shifts, and by the difficulties of giving quick service of hot meals and refreshments in very large and scattered plants. Copies of the Booklet may be obtained from the Secretary of the Society, 14, Hobart Place, Westminster, S.W.1, price 1s., or 1s. 2d. post free.

## "Fanfare"

The summer number of "Fanfare"—magazine of the Women's Gas Council—fully maintains the high standard set by its predecessors, and is, indeed, a tribute to the energy and enthusiasm which has always characterized the work if the W.G.C.

If the front cover conjures up memories of holidays, which most of us will have to forego this year, the contents is packed with useful and interesting matter on a wide variety of subjects—social, gardening, cookery, fashion, household hints, needlework and knitting, and news from H.Q. and the Branches. An excellent three-pennyworth.

# Control of Coal, Gas, and Electricity

The following Order (1940, No. 1284) has been made by the Board of Trade under Regulation 55 of the Defence (General) Regulations, 1939. Reference was made to it in last week's "JOURNAL."

No person shall (*a*) keep, store, move, transport, distribute, dispose of, acquire, use, or consume any coal, or (*b*) use or consume in any regulated premises any gas or electricity, in contravention of any direction given by the Secretary for Mines.

Every person who: (*a*) keeps, stores, moves, transports, distributes, disposes of, acquires, uses, or consumes any coal, or (*b*) uses or consumes in any regulated premises any gas or electricity, and the agents or servants of any such person, shall, if requested so to do by or on behalf of the Secretary for Mines, permit such person, or a person of such class or description, as may be authorized by the Secretary for Mines in that behalf to enter and inspect (and shall furnish the means required therefor) with a view to securing compliance with this Order, (i) any premises used for any of such purposes as aforesaid or (ii) any regulated premises in which any gas or electricity is used or consumed.

If it appears to the Secretary for Mines or to any such person, or to any person of such class or description, authorized as aforesaid that: (*a*) any coal has been, is being, or is likely to be kept, stored, moved, transported, distributed, disposed of, acquired, used, or consumed, or (*b*) any gas or electricity has been, is being, or is likely to be, used or consumed, in contravention of this Order, the Secretary for Mines or any such person, or person of such class or description, authorized as aforesaid may take or cause to be taken such steps as in his opinion are expedient for the purpose of securing compliance with this Order, and any person, and the agents and servants of any such person, in possession of any premises or regulated premises which have been, are being or are likely to be so used shall furnish any means required to enable such steps to be taken.

In this Order the expression "coal" means bituminous coal, cannel coal, anthracite, coke, and any manufactured fuel of which coal, anthracite or coke is the principal constituent, and the expression "regulated premises" means (*a*) any premises not used or appropriated wholly or mainly for industrial purposes, and (*b*) any premises used or appropriated wholly or mainly for industrial purposes, other than premises in which the quantity of coal supplied in the period of twelve months ended on June 30, 1939, and the quantities of coal equivalent to the quantities of gas and electricity so supplied were together more than one hundred tons.

For the purposes of this Order the quantities of gas and electricity equivalent to one ton of coal shall be taken to be 100 therms in the form of gas and 1,400 Board of Trade units of electricity respectively; provided that where gas is supplied by persons who are engaged in supplying gas or electricity to the public but who are not authorized to charge for gas according to the number of British Thermal Units supplied, the quantity of gas equivalent to one ton of coal shall be deemed to be 20,000 cu.ft.

# Linoleum and Incendiary Bombs

A marked distinction between combustibility and inflammability has been revealed in tests made on the protection offered by linoleum against fire caused by incendiary bombs. As the result of extensive trials conducted by the Linoleum and Floorcloth Manufacturers' Association, a brochure has been issued by the Association illustrating how, when a linoleum covering is used, the effect of a bomb is confined to the spot where it explodes, there being no spreading of the conflagration. The brochure describes tests on linoleum of varying thicknesses. In the case of a plain brown linoleum 6.7 mm. thick, 4½ minutes from the commencement of the ignition of the bomb the linoleum could be lifted up showing no penetration by the burning mass; 6½ minutes from the start the linoleum, when lifted, showed slight signs of penetration by the fire; 11 minutes from the start a slight crackling of ignited wood was heard, and after 35 minutes the original area covered by the burning bomb had not extended, and the wood underneath was charred on the surface, with a tendency to burn more deeply at the joints, especially where there was a chance of the air coming through at these points. The linoleum was only damaged immediately beneath the burning mass.

The conclusion to be drawn from the trials is that the retarding action of linoleum is an extremely useful property, because it gives the occupier valuable extra minutes for dealing with a burning bomb and localizes its burning area. Dry sand, slag or ashes spread over the floor have been recommended for protection against bombs, but the superiority of a layer of linoleum compared with these materials is at once apparent. It is easily cleaned and takes its place as part of the office or showroom furnishing; it does not interfere with the normal use of the premises and is light in weight.

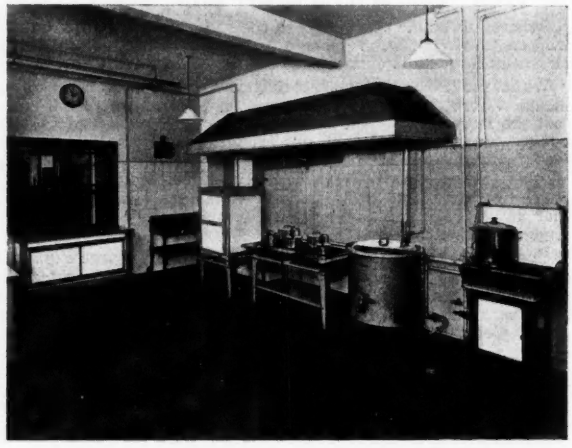
# Birmingham War Savings Group

## A Fine Effort

At the beginning of this year a National Savings Group, commenced by the Birmingham Gas Department during the last War, was in operation but had eight members only. When the special Savings Campaign started the Gas Committee and General Manager (Mr. A. W. Smith) were anxious that the Undertaking should play a worthy part in the movement. The first response of about five hundred new subscribers was promising, but nothing like what had been hoped.

Accordingly, officials of the Department gave 29 Certificates for ballots at the various works and depots in which they were especially interested, and members of the Gas Committee gave 24 more. It was decided to allot six of the latter at each of four ballots to be held at monthly intervals, three to be given to the works where the highest percentage contributing were employed, two to the runners-up and one to the works with the best improved percentage in the preceding month.

A forceful leaflet was published, meetings were held, and personal canvassing followed. The response justified the hopes of the Executive, and, to date, the total number of regular subscribers exceeds 2,200, and over £9,000 has been collected from them. The number represents 60% of the total number of employees and the best percentage yet attained is that of the Fittings Department and Meter Shops, which has reached over 78%. The Departmental result is better than any yet achieved in other Departments of the Corporation.



*This kitchen of the Tiffin County Girls' School, at Kingston-on-Thames provides from seventy-five to a hundred meals daily. Roasting oven, boiling table, vegetable boiler, carving table and hot closet, and "New World cooker"—all save the last-named in mottled porcelain enamel finish—were supplied to the Surrey County Council by Radiation, Ltd.*

# British Standards for Precision Tools

Two further specifications have recently been issued by the British Standards Institution in the series of British Standards for Engineers' Precision Tools. These relate to Engineers' Steel Parallels (B.S. 906) and Dial Gauges for Linear Measurements (B.S. 907).

The Specification for Engineers' Steel Parallels deals with the general dimensions and permissible errors in parallel blocks of sizes ¼ in. by ½ in. by 4 in. to 2 in. by 4 in. by 16 in. Provision is made for two grades of accuracy, one for high precision work and the other for general tool room use.

The Specification for Dial Gauges applies to the most commonly used type of gauge in which the plunger movement is parallel to the dial. It does not cover gauges with a back plunger movement. The main purpose of the Specification for dial gauges is to establish standards of accuracy. Considerable latitude is allowed in the general design of the gauge, although certain requirements are included in respect of matters of detail where these have a direct bearing on the initial accuracy or the maintenance of the accuracy or on the ease with which the dial gauge may be read.

The Tables of permissible errors cover dial gauges from 1¼ in. to 2 in. diameter, measuring by steps of 0.001 in., 0.005 in., 0.0001 in., and 0.01 mm. The Appendix to the Specification gives notes on various methods of testing dial gauges, with particular reference to the accuracy of calibration.

Copies of these Specifications (Nos. B.S. 906 and 907) can be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 3d. each, post free.

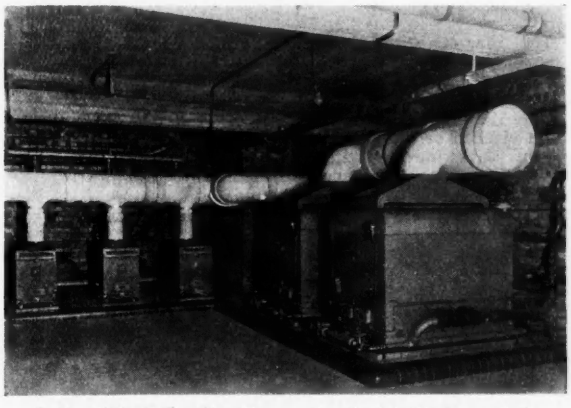
*Notable Progress in*

# GAS CENTRAL HEATING

EVER since the outbreak of war—and, indeed, for long before that—the columns of the "JOURNAL" have borne witness to the reliance which is placed in gas water heating equipment for A.R.P. and industrial purposes. Among all this wealth of information, dealing for the most part with one or a limited number of relatively small heating units, there has been a tendency to overlook the many larger installations which in the meantime have been steadily taking shape.

For this reason we were glad to have the opportunity the other day of inspecting several extensive gas central heating systems now in course of completion in the area of the Croydon Gas Company. And, it may be added, these are typical of countless other installations now in progress in every corner of the land—many of them serving vital industries and playing an essential part in maintaining the efficiency of munitions production by providing comfortable conditions for the workers.

Two principal reasons may, perhaps, be cited for the present boom in gas central heating and hot water supply—and boom it is, though many of the installations are in places which, obviously, are better left unspecified. These reasons are, first, a true appreciation of the need for automatic, efficient, and trouble-free service which



*A view of the Boiler Chamber serving the Hospital installation described in the accompanying text—reproduced by kind permission of Sir Henry Berney, J.P. (the Architect), on behalf of the Hospital Authorities*

does not demand the employment of a stoker or other attendant, or the labour involved in delivering fuel, in order to keep the plant in operation, at a time when our man-power is urgently required for more important duties; and, secondly, a realization that a clean, smokeless, home-produced fuel, the mere use of which releases by-products indispensable for the prosecution of the war, is the best fuel to adopt in the National interests.

Among a considerable number of important central heating and hot water supply installations lately completed or still in course of completion in the Croydon area are two or three which we think will be of particular interest to our readers in that they serve totally different types of building—in one case a hospital and in others a factory—and employ different systems of circulation.

## A Hospital Installation

At the outbreak of hostilities a large hospital in this area had planned a big programme of extensions, including an entirely new building for out-patients and emergency, two blocks of new wards, and a kitchen block to serve both old and new buildings. In conjunction with these extensions it was decided to convert the original solid fuel boilers to an up-to-date gas central heating system.

Although the programme had to be to some extent curtailed as a result of the war, the new out-patients department is now nearing completion, and in it have been embodied certain modifications to make it suitable as a first-aid post and cleansing centre "for the duration." At the same time the new gas boiler chamber is being proceeded with, and space is being provided for additional plant to serve the future extensions when they are completed.

The central heating is carried out by means of an accelerated low-pressure hot water system with special "hospital" pattern radiators in the various departments. The initial plant consists of two No. 3 Series "Rex" boilers of six sections each, having a combined output of 1,500,000 B.Th.U. per hour, and serving in the new buildings 57 radiators of approximately 2,600 sq.ft. of heating surface. The solid fuel boilers serving the old building are now being dismantled, and mains have been laid across the intervening space to headers in the old boiler chamber, to which the various circulations will be connected—so that the gas boilers will eventually serve the whole premises.

The considerable quantities of hot water always required by a hospital are provided by three "D" Series "Rex" boilers having a total output of 594,000 B.Th.U. per hour, with two 200-gallon storage cylinders. In addition to 37 draw-off points throughout the new building, this plant serves airing coils in the linen and mattress stores and also two radiators in the emergency dressing station of the new out-patients department. This room can thus be maintained at the requisite temperature during periods when weather conditions do not require the main central heating plant to be in operation.

In this case also separate mains are taken from the gas boilers to the old boiler chamber, connecting to the storage cylinders which supply the original portion of the hospital. The future plant for which provision has been made pending the completion of the extensions programme includes an additional central heating boiler, a further "D" Series hot water supply boiler, and a third 200-gallon storage cylinder.

The automatic control of this plant is of interest, as in addition to the standard water temperature thermostat and automatic gas cut-off equipment with which all boilers are fitted, provision is also made for controlling the central heating boilers by means of an air temperature thermostat, while the relatively extensive secondary circulation serving the out-patients department is controlled by a clock operating through a gas pressure valve, which will shut off the circulation during the night, but can easily be by-passed to keep the heating going in case of emergency.

The new gas boiler chamber is a model of its kind, the grey mottled enamel boilers standing on raised beds finished in glazed brown tiling, the neat pipe and flue running work and chromium-plated fittings constituting the essence of cleanliness and efficiency which should be the *sine qua non* of every modern hospital.

## New Factory Buildings

Another installation of particular interest is that serving the new extensions of a firm which has for some time past fully appreciated the advantages of gas firing for the central heating and hot water supply in its many premises. Indeed, since 1936 all the new buildings erected by the firm have been served by low-pressure systems heated by "Rex" boilers, the output of which aggregates no less than 2,500,000 B.Th.U. per hour.

To meet the growing demand for its products, the firm have lately commenced the erection of a further large three-storey building which will call for a heating capacity of 1,250,000 B.Th.U. per hour in each of the three bays. The first of these bays is now nearing completion, and a No. 3 Series "Rex" boiler of ten sections, having the above rating, is already installed, while space has been provided for a second unit of the same capacity to serve the second bay.

In this case the heating mains are carried direct to the top floors with drop feeds through the radiators, there being two circuits, one

*In this Emergency Department of the Hospital extensions described in the accompanying article the radiators are on the hot water supply circuit, so that the temperature can be maintained at the requisite level during periods when the main central heating system is not in operation*

for each side of the building. In order to take up the least amount of valuable space the radiators are of the "wall pattern" type, and, in contradistinction to the pipe lines in the hospital installation, which are all well lagged, the feeds here are exposed so as to augment the heating capacity of the system. The total heating surface will thus be approximately 5,000 sq.ft. The system is accelerated by a pump of sufficient capacity to deal with the second bay when completed.

There are two independent sets of lavatories on each floor, with a total of 80 taps serving washing troughs for both male and female employees, while basins are fitted in a number of private lavatories. These two tiers of lavatories will each be served by a "D" Series "Rex" boiler and a 150-gallon storage cylinder.

Another well-known firm which has lately extended its premises to cope with expanding business is changing over to gas. In this instance the original buildings were served by a coke boiler; but when the new wings were designed it was decided to adopt gas firing for central heating and to dispense with the old solid fuel installation so that both old and new buildings would be on one system.

The boiler here is a No. 3 Series "Rex" of ten sections, which has an output of 1,250,000 B.Th.U. per hour and is housed in an external heating chamber. There are two new buildings served by a series of overhead heating pipes, operating by gravity circulation, while the circulation in the old buildings is by separate extended mains which employ the same method of acceleration as was in use with the old solid fuel plant.

### For Offices and Laboratory

An installation of interest in another area is the gas-fired central heating in a new building which is to form the offices and laboratory of a Small Arms Inspection Department.

The building is of two storeys, the ground floor being utilized for independent offices and laboratory, while the upper floor in the present construction is an open room—but the heating apparatus had to be so designed that it can be partitioned off into sections with temporary positions to suit varying requirements without causing undue concentration of heat in any one particular section.

The boiler is housed in the basement, but the system has been designed on the overhead drop principle, the flow rising to a high level on the upper floor thence distributing with branches and reduced extensions serving drop pipes through the two floors, with returns coupled into a horizontal main at skirting line on ground floor so that radiators may be fitted under each window. Water mains in the basement are thus avoided. The circulation is by thermo-syphon, and with the drop principle the whole of the system is in this way automatically vented.

The 49 radiators provide a total heating surface of 1,220 sq.ft., mostly wall pattern, and the boiler for this duty is a No. 2 Series 5-section "Rex" in enamelled finish, rated at 360,000 B.Th.U. per hour.

The boiler controls comprise an automatic gas cut-off to shut off the supply in case of flame failure, together with two air temperature thermostats, one for day and the other for night and week-end temperatures, with a clock control to change from one to the other at predetermined times.

The foregoing are but a few of many interesting gas heating installations on hand at the moment. They are typical of the service which the Gas Industry is rendering at the present time, and they foreshadow the greatly extended central heating and hot water supply load to which the Industry may confidently look forward in the future.

# Coals Dangerous to Coke Ovens

**By Dr. R. A. Mott**

*From a Paper at a joint meeting of the Institute of Fuel and the Coke Oven Managers' Association*

ALL tests, large and small scale, which have been suggested to measure the liability of a coal to damage oven walls are open to error; no universally satisfactory test can be devised unless the cause of the dangerousness of coals to oven walls is known, and unless certain precautions are taken in the test.

All coking coals must be swelling coals, but a swelling power, *per se*, is not the cause of damage to oven walls. It is well known that the shrinkage of cokes in an oven is proportional roughly to the volatile matter. The shrinkage cracks begin as soon as the coke has passed through the plastic layer.† In a coke oven, the shrinkage of the semi-coke outside the plastic layer opposes the swelling pressure of the coal in the plastic layer, and a dangerous pressure is only exerted on the oven wall if the shrinkage does not balance the swelling. Durham coals are being successfully coked which swell over 300% in the Sheffield laboratory coking test, but no example of damage to oven walls is well known in that area. On the other hand, in the areas where damage to oven walls has been caused, in South Wales, Germany, and America, low volatile coals have always been used. The cause of damage is not, therefore, high swelling power, but high swelling power accompanied by low shrinkage; and low shrinkage associated with low volatile matter is a more dominant factor than high swelling power which may be found in high volatile but safe coals.

TABLE 1.

CHARACTERISTICS OF COALS POSSIBLY DANGEROUS TO COKE OVENS.

| No. | | Dangerous at bulk density.§ | Vol. mtr.‖ | Cal. val. | Swelling power. | | Modified test 3. | |
|---|---|---|---|---|---|---|---|---|
| | | | | | B.S.I. number. | S.L.C.T. % | Swelling, %¶ | Contraction, %¶ |
| 1 | American 1 | Over 625 | 17.2 | 15,750 | 8 | nil | 4.5 | 0 |
| 2 | German 1 ... | 650 | 20.0 | 15,900 | 7½ | nil | 3.7 | 1.8 |
| 3 | S. Wales 2 | 700 | 25.5 | 15,840 | 9 | 165 | 10.4 | 3.0 |
| 4 | German 2 ... | 725 | 22.6 | 15,850 | 9 | 89 | 3.0 | 3.7 |
| 5 | S. Wales 7 ... | 725 | 24.7 | 15,880 | 9 | 105 | 2.2 | 4.4 |
| 6 | American 3 | 750 | 18.2 | 15,800 | 7 | 31 | 0 | 5.9 |
| 7 | S. Wales 6 ... | 775 | 22.1 | 15,800 | 7½ | — | 0 | 6.7 |
| 8 | American 2 | 775 | 22.4 | 15,700 | 9 | 92 | 0 | 8.9 |
| 9 | Kent ... | 800 | 25.5 | 15,980 | 9 | 182 | 1.0 | 9.6 |
| 10 | S. Wales 8 ... | 800* | 22.5 | 15,675 | 8½ | 119 | 0 | 9.6 |
| 11 | German 3 ... | 825* | 27.3 | 15,655 | 5½ | 136 | 0 | 10.3 |
| 12 | S. Wales 9... | 825* | 19.6 | 15,800 | 8½ | 93 | 0 | 10.4 |
| 13 | S. Wales 11 | 825* | 21.9 | 15,700 | 8½ | 90 | 0 | 11.1 |
| 14 | S.Wales1 ... | 825* | 17.3 | 15,710 | 3½ | nil | 0 | 11.1 |
| 15 | Durham 16 | 850 | 26.8 | 15,760 | 9 | 176 | 0.8 | (11.5)† |
| 16 | American 4 | 850 | 27.2 | 15,550 | 8½ | 28 | 0 | 11.8 |
| 17 | S. Wales 10 | 850* | 16.1 | 15,790 | 5½ | nil | 0 | 12.6 |
| 18 | S. Wales 3 ... | 850* | 25.4 | 15,875 | 8 | 116 | 0 | 12.6 |
| 19 | Somerset ... | ‡ | 29.8 | 15,670 | 9 | 228 | 1.6 | 8.0 |

* Deduced from contraction at 750 kg. per cub. m.
† Deduced, determined value abnormal. ‡ Over 800 kg. per cub. m.
§ Kg. per cub. m. ‖ Parr basis. ¶ At 750 kg. per cub. m.

The deduction that coals with a volatile matter exceeding 25.5% Parr basis are not dangerous at a bulk density of 750 kg./m³ is in accord with this. This is an important deduction in practice because it excludes all Yorkshire and Durham coals, though, since some Durham coals approach the limit of 25.5% volatile matter, care may be necessary to avoid excessive bulk densities for such coals.

The characteristics of the most dangerous of the coals examined are summarized in Table 1, the coals being arranged in order of dangerousness assessed on a basis of the contraction in the modified Koppers test 3.

Only the first six coals are so dangerous that they would have to be blended before use. Coals 7 to 14 could be used alone as washed slacks of moderate bulk density, and coals 15 to 18 could be used alone under all conditions avoiding excessive bulk densities.

Coals 1 to 6 are all of a calorific value exceeding 15,750 B.Th.U./lb. (Parr basis) and usually over 15,850 B.Th.U./lb., unusually high values which gives an additional datum for their recognition. They contain 17 to 25.5% of volatile matter. They all have high B.S. swelling numbers, though only three have the maximum value (9) recordable. In the Sheffield laboratory coking test the two most dangerous coals are non-swelling, and the swelling of three of the others is only moderate. This illustrates well that swelling power, *per se*, is not the cause of dangerousness. The fact that American 1 coal is non-swelling at a slow rate of heating and is strongly swelling at a fast rate shows how sensitive is this coal to the rate of heating and how such a coal might be dangerous at one rate of heating, and at another would not even give a coherent coke.

Coals 9, 15, and 19 are very strongly swelling in the Sheffield laboratory coking test. These coals have tended to give difficulties in interpretation. A preliminary test in the Sheffield laboratory coking test is, therefore, a useful preliminary to a pressure-swelling test. Coals with B.S. swelling numbers of 8½ or 9 are those which should always be tested with the dust removed. It may be noted that this use of graded coal has been shown not to cause differences in the petrographic composition of the coal, except in removing fusain.‡

One result of our work has been to emphasize the narrow range within which dangerous coals lie and to show that a standardization based on German coals is not applicable to all types of British coals. It also shows that undue importance has been attached to the percentage swelling or the swelling pressure and insufficient to the contraction in a pressure-swelling test. Since the contraction under constant load can only be measured satisfactorily in the Koppers swelling test, this test is recommended for adoption in preference to the Nedelmann or Baum-Heuser tests. Moreover, the standard of a dangerous coal in the Nedelmann test (based on a bulk density of 830 kg./m³ (52 lb./cu.ft.)) is too high for plants coking wet slacks where the bulk density is under 46 lb. per cu.ft.

The Koppers test, as previously used, did not allow efficient combustion of the gas. The use of eight waste gas off-takes from the burner (with a common combustion space) is desirable, and the upper brick round the steel crucible should be of insulating firebrick, such as Gibbons HT1 or other solid insulating brick which will stand a high temperature. Both bricks can conveniently be made of the same material. The use of sized coal, 10-20 mesh I.M.M. (14-25 B.S. mesh), is essential to avoid erroneous readings with coals which develop excessive plasticity.

Since the dangerousness of a coal must be related to the bulk density we suggest that tests be carried out at bulk densities of 700, 750, and 800 kg./m³. Doubtful points should be checked and the bulk density at which a coal would be dangerous can be deduced, the values at 750 kg./m³ being used as the standard when a wet slack is coked and those at 800 kg./m³ for dry slacks.

† Davies and Wheeler, "The Formation of Fractures in Coke," Yearbook, C.O.M.A., 1932, p. 81.
‡ Fuel, 1939, pp. 18, 376

# X-RAY STUDY OF CARBONIZATION*

THE investigations of crystallite growth during carbonization in the temperature range 400° to 1,300° C. have been extended to include one American and two Welsh anthracites, bituminous coals, lignin and samples of Irish peat and turf, and carbonization temperatures up to 2,200° C. The high temperature studies involved the construction of a carbon tube resistance furnace. Temperatures of 3,400° C. have been reached in this apparatus.

Up to carbonization temperatures of 1,300° C., the dimensions of the crystallites present in the cokes prepared from the various carbonaceous materials were all extremely minute. In fact, the differences from coke to coke were surprisingly small. Whereas the reaction $2CO = C + CO_2$ gives carbon, the crystallites of which may have *a* and *c* dimensions up to 200 Å, the cokes prepared by the carbonization of the above materials had crystallites the dimensions of which varied from 10 to 35 Å. Above 1,300° C., the exact temperature depending upon the nature of the carbonaceous material and of the inorganic constituents, pronounced growth occurred, presumably due to thermal crystallization.

With carbonaceous materials, relatively free from ash—*e.g.*, cellulose and lignin—the crystallite growth curves up to 1,300° C.

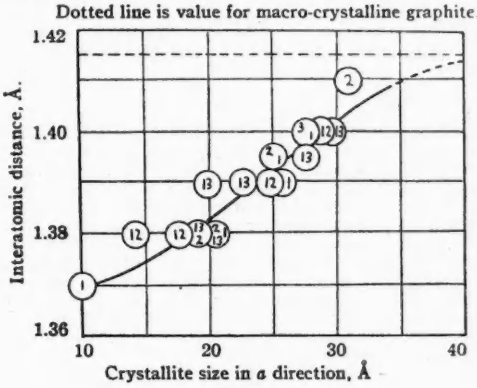



FIG. 1

Variation of Interatomic Distances with Crystallite Size in *a* Direction: 1, cellulose carbons; 2, S. W. anthracite C527; 3, peat; 4, coke C518; 5, coke C383; 6, lignin; 7, wood; 8, coke C526; 9, coke C528; 10, coke C458; 11, pentadiene carbon; 12, S. W. anthracite C607; 13, American anthracite C618

were relatively simple, the *a* dimensions showing a steady increase, the *c* dimension remaining constant. Certain bituminous coals—*e.g.*, a Northumberland and a Durham coal—gave the same type of crystallite growth curves. The anomalous *c* dimension/carbonizing temperature curve already described in Annual Report No. 10 is apparently characteristic of certain types of coal, for similar curves have been obtained in the carbonization of another Welsh anthracite, an American anthracite, and a West Yorkshire bituminous coal. The cause of this disruption of the crystallites of certain coals during the early stages of carbonization has not yet been elucidated.

The anomalously rapid growth in the temperature range 700° to 1,000° C. of both the *a* and *c* dimensions of the crystallites formed in the carbonization of peat has been further investigated. Other Irish peats, but not turfs, gave similar results. The anomalous growth was not prevented by carbonizing in high vacuum. Preliminary extraction of the peat with dilute hydrochloric acid, however, gave a residue which behaved normally. This result and the high ash content of the peat char suggested that this phenomenon might be due to presence of ash. An X-ray study was therefore made of the effect of inorganic admixtures upon the crystallographic properties of chars prepared from pure cellulose. Boric acid, zinc chloride, aluminium chloride, hydrogen chloride, calcium carbonate, silica, iron oxide, sodium carbonate, and potassium carbonate were used. The results obtained indicated that the addition of these reagents to the cellulose before carbonization brought about only minor alterations in the crystallographic properties of the chars prepared from it at 600° and 1,000° C. Small changes in the *a* dimension were recorded in certain cases, but no change in the *c* dimension. The considerable increase in carbon yield which occurred in almost every case indicated that the primary action of the admixture was the formation of nuclei around which aromatic condensation could occur. The result obtained with hydrogen chloride at 1,000° C. was particularly striking, in that the yield of carbon was almost 100% of that theoretically possible.

A clue to a possible cause of this anomalous growth was obtained by carbonizing cellulose in an atmosphere of ammonia. The crystallites in the 1,000° C. char had average dimensions *a* 19.7 Å and *c* 13.0 Å compared with *a* 19.9 Å and *c* 10.1 Å for a specimen prepared under the same conditions but in an atmosphere of nitrogen. This was the first occasion on which growth along the *c* axis was promoted in the carbonization of an ash-free carbonaceous substance at relatively low temperatures.

It has already been shown (Annual Report No. 10) that the C-C spacing is an inverse function of the number of layer planes in the carbon crystallite. It has now been found that the

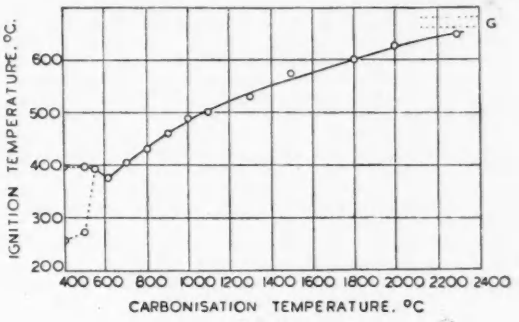



FIG. 2

The Influence of Carbonisation Temperature on Ignition Temperature.
G = Graphite

C-C spacing in the layer planes also shows an interesting variation with crystallite size. The C-C spacing in the layer planes of macrocrystalline graphite is 1.415 Å: in the microcrystalline carbons studied it was approximately 1.37 to 1.38 Å. The C-C distance increases as the crystallites grow. Fig. 1 illustrates this increase in interatomic distance with increase in the *a* dimension of the layer plane.

## An X-Ray Study of Coalification

Experiments have been initiated with the objective of gaining a more intimate knowledge of the process of coalification in general and of the fundamental nature of coking coals in particular. The problems involved are exceedingly complex and have already been subjected to much purely chemical investigation. By employing the X-ray technique already developed in our studies of carbonization, it was hoped to supplement this chemical knowledge of coal structure with information concerning crystallite dimensions and by the study of a genetically related series of coals to learn something of the building up of these dimensions during coalification.

The Debye-Scherrer photograph of a bituminous coal is more complex than that of the cokes prepared from it. A detailed study was therefore first made of the Debye-Scherrer photographs of a Durham coking coal and of the $\alpha$, $\beta$ and $\gamma$ and $\gamma_1$, $\gamma_2$ and $\gamma_3$ fractions obtained from it by solvent extraction. Although the full interpretation of the photographs at this stage is not possible, they provide, together with our chemical, knowledge of coal sufficient guidance to permit a tentative interpretation of the powder photographs of coal in general.

Although X-ray photographs of coals of widely different rank have been taken, no systematic investigation of coals, from the same seam, but of different rank, has hitherto been undertaken. This has now been made possible by the courtesy of the Director of Fuel Research, who placed a series of such samples at our disposal. The results obtained have been interpreted in the light of information gained in the X-ray studies of the solvent extracts. The six coals investigated had volatile contents ranging from 36.1 down to 10.3%. The most interesting feature of the results obtained was that the *a* dimension of the crystallites remained substantially constant at about 11 Å throughout the series in spite of the considerable change in rank, and that the *c* dimension showed a pronounced increase from 15.4 Å to 19.6 Å as the rank of the coal increased. In view of the work of Bone and co-workers and of Corriez, these results appear to be of particular significance. There can be no doubt that aromatization or the development of benzenoid characteristics plays an important part in coalification, but the above results indicate that it is only half the story. Coalification is a fundamentally different process from carbonization, otherwise it would be possible to obtain good coking coals from coals of low rank by means of some relatively simple thermal treatment. The continuation of the above investigation appears to offer the possibility of gaining a much deeper insight into the factors which determine the development of coking properties in coals.

The C.A.B. test has proved a useful means of assessing coke combustibility, and the results obtained by this method give in

* From the Annual Report for 1939 of the Northern Coke Research Committee

the majority of cases a correct indication of the combustibility of the coke under certain practical conditions. As a research tool, however, the method has the serious disadvantage that it requires a relatively large amount of graded sample. The speed at which an investigation can be conducted is frequently determined by the size of the sample employed. Provided precautions are taken with regard to sampling and the interpretation of results, it is often possible to multiply the speed of an investigation several times, if micro-methods are used. There has been considerable reluctance on the part of those engaged in coke research to scale down their experiments and achieve this greater output. Any investigation which sets out to make a comprehensive contribution to the subject of coke combustibility must include a large number of different types of carbon prepared under different conditions from a variety of carbonaceous materials, the effect of the addition of catalysts, the effect of impurities, &c. It is therefore obvious that a relatively simple experimental procedure must be adopted, otherwise the investigation would require an inordinately long time. Two different micro methods were therefore investigated, the one utilizing the principle of the C.A.B. test but employing a much smaller apparatus and the other depending upon the measurement of the "ignition temperature." Both methods proved satisfactory, but as the second permitted a reproducible assessment of the relative combustibility employing only 0.2 g. of sample ground to pass a 200 mesh sieve, the latter method was adopted for the systematic study.

Although the term "ignition temperature" applied to a coal or coke has no fundamental significance as its value must depend largely on the method of measurement, the close correlation obtained between the results obtained in this new micro test and the C.A.B.'s of the same cokes indicated that reliance could be placed upon this new method of assessing coke combustibility. A series of cokes also gave excellent correlation between their "ignition temperatures" and their micro strength indices.

The results obtained in a series of experiments upon the effect of carbonizing temperatures up to 2,300° C. upon the ignition temperature of cellulose carbon indicated the importance of the effect of crystallite dimensions upon combustibility. The ignition temperature/carbonizing temperature curve approached the ignition temperature of Ceylon graphite symptotically. These results are shown in Fig. 2.

In the case of cokes and chars prepared at temperatures below 550° C., the existence of two distinct "ignition temperatures" was established. The first was at about 250° C., and the second in the neighbourhood of 300° to 400° C. A similar phenomenon has been observed in the case of certain coals and is related to their rank.

A study has also been made of the qualitative and quantitative effects of the addition of alkali carbonates and other inorganic substances. The results indicated that the effect of the addition of sodium carbonate was to catalyze the carbon-oxygen reaction and not the reaction between oxygen and the residue volatile matter.

It was inferred from the results obtained that the ignition of cokes prepared at temperatures below 600° C. and of coals was initiated by the reaction between oxygen and the complex hydrocarbons rather than by the carbon-oxygen reaction. Supplementary experiments indicated that this ignition was preceded by a pronounced adsorption of oxygen.

In view of the importance of coke reactivity at the present time, it is hoped to publish details of these experiments in the near future.

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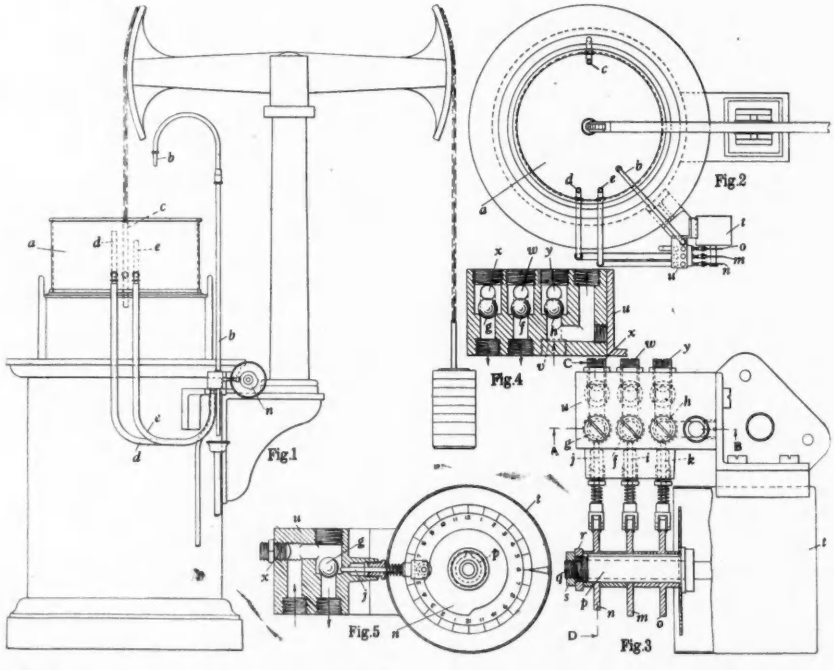
# Automatic Gas Governors

The object of a patent taken out by Meters, Ltd., H. H. Mitchell, and A. Whatmore (No. 522,307; application date, Sept. 15, 1939) is to provide improved means for the automatic control of the liquid loading of the bell of a gas governor.

Fig. 1 is a general diagrammatic view of the governor, Fig. 2 is a plan view of part of Fig. 1, Fig. 3 is a view of part of Fig. 2 drawn to a larger scale and with certain details in section, Fig. 4 is a sectional view on the line A B of Fig. 3, and Fig. 5 is a sectional view on the line C D of Fig. 3.




The governor loading tank is shown at *a* and water is supplied through the pipe *b*. There are three overflow pipes *c*, *d*, and *e*. The pipe *c* governs the maximum loading of the tank, the pipe *d* the intermediate loading, and the pipe *e* the minimum loading. The maximum level overflow pipe *c* is always open but the overflow pipes *d* and *e* and the inflow pipe *b* are controlled by valves *f*, *g*, and *h* respectively, which are opened by plungers *i*, *j*, and *k* actuated by cams *m*, *n*, and *o*. The latter are keyed to a sleeve *p* and are clamped to a clockwork operated spindle *q* by a nut *r* and locknut *s*. The clockwork mechanism is indicated at *t*.

The cams *m*, *n*, and *o* are shaped to give certain desired periods of opening and closing to the valves *f*, *g*, and *h* so as to increase the governor loading or to reduce it as may be required to suit the demands for gas at certain periods of the day. Thus, for example, the overflow pipe *d* may be evacuating the tank *a* down to its level due to the valve *f* being opened by the cam *m* and plunger *i* during the morning, say, from 9 to 12 o'clock and in the afternoon from 1.30 to 11 o'clock. The pipe *b* may be supplying liquid to the tank to build the level up to the overflow *c* to give the maximum gas pressure between 5.30 and 9 o'clock in the morning and from 12 to 1.30 in the afternoon, while the overflow pipe *e* may be evacuating the tank *a* down to its lowest level between 11 at night and 5.30 in the morning.

The water inlet connexion to the valve housing or fitting *u* which contains the valves *f*, *g*, and *h* is at *v*.

Associated with each valve is an adjustable screw *w*, *x*, or *y* which serves to determine the rate of overflow or inflow of water from or to the tank.

The arrows in Figs. 4 and 5 indicate the general direction of flow of the water through the housing *u* past the valves *f*, *g*, and *h*.

The cams driven by the clockwork *t* can be readily changed to give different timings of the opening and closing of the inflow and outflow valves and any number of cams and overflow pipes may be used to increase the range of loadings of the governor.

# INSTITUTION OF GAS ENGINEERS

## Results of 1940 Examinations

THE undermentioned Candidates were successful in the 1940 Examinations in Gas Engineering (Manufacture), Gas Engineering (Supply) and Gas Supply of The Institution of Gas Engineers, held under the Education Regulations of The Institution of Gas Engineers, as approved by the Government Education Departments of Great Britain and Ireland.

Appended is the Report of the Board of Examiners on the 1940 Examinations.

### EXTERNAL CANDIDATES (68)

*Diploma in Gas Engineering (Manufacture)* (12)

| Class. | Name. | Town. | Subject of Thesis. |
|---|---|---|---|
| First | Blenkiron, A. | Bradford | "Testing and Evaluation of Coals with Particular Reference to (*a*) Test Plant of 5 × 10 ft. Stop End Horizontals. (*b*) Test Plant of 2 × 5 ton W.D. Continuous Verticals." |
| ,, | Castle, J. | Brighouse | "An Investigation into Practical and Economic Aspects of Waste Heat Recovery on an Existing Horizontal Setting." |
| ,, | Hogg, J. C. | Stretford | "Treatment and Circulation of Ammoniacal Liquor on a New Gas Works." |
| ,, | *Ricketts, T. S. | Hertford | "Increasing the Throughput of a Horizontal Retort Bench." |
| Second | Baird, W. N. | Dunfermline | "The Relative Thermal and Financial Values of One Class of Coal and the Principal Products Associated with its Carbonization in Vertical Retorts." |
| ,, | Birks, H. E. S. | Grantham | "Air Raid Precautions and a Modern Gas Works." |
| ,, | Cook, G. R. T. | Wirral | "The Design and Control of Modern Horizontal Retort Settings." |
| ,, | Field, A. | Snodland | "Design and Construction of a 250,000 Cu. Ft. High Pressure Gasholder." |
| ,, | Patching, H. J. | Peterborough | "The Removal of Sulphuretted Hydrogen from Coal Gas." |
| ,, | Royden, G. | Uddingston | "The Construction and Operation of a 2,000,000 Cu.Ft. Waterless Gasholder, with Particular Reference to Safety and Air Raid Precautions." |
| ,, | Smith, J. | Hinckley | "Manufacture of Concentrated Ammoniacal Liquor." |
| ,, | Young, C. A. W. | Shrewsbury | "Some Experiences in Retort House Maintenance." |

*Higher Grade Certificate in Gas Engineering (Manufacture)* (12)

| Class. | Name. | Town. |
|---|---|---|
| First | Rich, J. B. | Torquay |
| ,, | °Shortland, G. | Sunderland |
| ,, | Sorley, J. | Motherwell |
| Second | Buckley, H. | London |
| ,, | Burton, E. W. | Pontefract |
| ,, | Croad, G. | Hebden Bridge |
| ,, | Gardner, D. | Motherwell |
| ,, | Guyan, J. | Aberdeen |
| ,, | Humphries, G. D. | Blackburn |
| ,, | Jessop, W. R. | Heywood |
| ,, | Payne, E. K. | Reading |
| ,, | Stapley, H. G. | Redditch |

*Ordinary Grade Certificate in Gas Engineering (Manufacture)* (13)

| Class. | Name. | Town. |
|---|---|---|
| First | Britton, J. C. | Hinckley |
| ,, | Gregory, J. R. | Darwen |
| ,, | Sweeting, K. J. | Taunton |
| Second | Bryce, W. J. | Knowsley |
| ,, | Hartley, J. F. | Colwyn Bay |
| ,, | Howell, J. T. S. | Camberley |
| ,, | Oliver, F. B. | Hawick |
| ,, | Silvey, G. A. | Marlow |
| ,, | Taylor, M. H. | Clitheroe |
| ,, | Terry, G. R. | Blackburn |
| ,, | Whitestone, P. D. | London |
| ,, | Willis, A. J. | Sherborne |
| ,, | Worters, P. A. | Ulcombe |

*Ordinary Grade Single Subject) Examination in Gas Engineering (Manufacture) to qualify to sit for the Diploma Examination in Gas Engineering (Supply)* (1)

| Class. | Name. | Town. |
|---|---|---|
| First | Blane, D. F. | Bletchley |

*Higher Grade Certificate in Gas Engineering (Supply)* (9)

| Class. | Name. | Town. |
|---|---|---|
| First | Davison, D. W. | Aberdeen |
| ,, | Tomes, J. A. | Walsall |
| Second | Gillespie, A. V. | Dublin |
| ,, | Harrison, R. K. | Southampton |
| ,, | Groom, R. D. | Southport |
| ,, | Heywood, S. | Liverpool |
| ,, | Tarn, W. H. | ,, |
| ,, | Thomas, E. C. | Portsmouth |
| ,, | Witcombe, H. F. | Rhondda |

*Certificate in Gas Supply* (1)

| Class. | Name. | Town. |
|---|---|---|
| Second | Pringle, T. G. | Edinburgh |

*Ordinary Grade Certificate in Gas Engineering (Supply)* (15)

| Class. | Name. | Town |
|---|---|---|
| First | Ernest, K. M. | Penarth |
| ,, | °Fairman, J. R. | Southampton |
| ,, | °Grundy, J. M. | Bolton |
| ,, | Holland, J. | Stockport |
| ,, | Robson, F. L. | Sheffield |
| Second | Eaves, W. | Halifax |
| ,, | Forrester, N. | Long Eaton |
| ,, | Magson, J. H. H. | Dorchester |
| ,, | Marsh, A. E. | Birmingham |
| ,, | Oliver, F. B. | Hawick |
| ,, | Perry, W. F. | Bristol |
| ,, | Potter, H. | Birmingham |
| ,, | Surman, R. E. | Hinckley |
| ,, | White, J. D. | Birmingham |
| ,, | Willis, A. J. | Sherborne |

*Ordinary Grade (Single Subject) Examination in Gas Engineering (Supply) to qualify to sit for the Diploma Examination in Gas Engineering (Manufacture)* (5)

| Class. | Name. | Town. |
|---|---|---|
| First | °Blinkhorn, A. | Bolton |
| ,, | Dickson, A. E. | Sheffield |
| ,, | Pedler, T. W. | Alphington |
| ,, | Petch, G. H. | Southampton |
| ,, | Shillington, T. F. | Belfast |

### INTERNAL CANDIDATES (108)

*Higher Grade Certificate in Gas Engineering (Manufacture)* (26)

| Class. | Name. | Centre. |
|---|---|---|
| First | Brock, A. | Glasgow |
| ,, | Portchmouth, A. P. | Regent Street |
| Second | Aveyard, C. | Bradford |
| ,, | Bennett, R. | Sheffield |
| ,, | Brown, H. | Manchester |
| ,, | Carter, N. | Sheffield |
| ,, | Crane, H. V. | Regent Street |
| ,, | Cutler, W. J. | ,, |
| ,, | Dyche, G. H. | Derby |
| ,, | Fleming, J. B. | Glasgow |
| ,, | Fornachon, G. | Manchester |
| ,, | Foster, H. | ,, |
| ,, | Hayes, C. | Regent Street |
| ,, | Jarrett, L. W. | ,, |
| ,, | Maw, F. H. | Huddersfield |
| ,, | Pawley, R. F. D. | Plymouth |
| ,, | Randell, R. J. A. | Regent Street |
| ,, | Sage, E. R. | Glasgow |
| ,, | Santley, R. | Manchester |
| ,, | Sherratt, J. | Derby |
| ,, | Smith, J. B. MacR. | Manchester |
| ,, | Smith, R. B. | Newcastle-upon-Tyne. |
| ,, | Styring, J. | Huddersfield |
| ,, | Tate, P. | Sheffield |
| ,, | Tooby, C. B. | Manchester |
| ,, | Ward, H. | ,, |

*Ordinary Grade Certificate in Gas Engineering (Manufacture)* (19)

| Class. | Name. | Centre. |
|---|---|---|
| First | Barker, F. C. | Bradford |
| ,, | Cameron, T. R. | Edinburgh |
| ,, | Marshall, J. C. | Glasgow |
| ,, | Patterson, S. K. | Edinburgh |
| ,, | Simpson, A. | Glasgow |
| Second | Askin, B. M. | Manchester |
| ,, | Bryson, R. | Glasgow |
| ,, | Buchan, A. P. | Kirkcaldy |
| ,, | Dickson, R. R. | ,, |
| ,, | Gray, L. | Blackpool |
| ,, | Harris, H. H. | Plymouth |
| ,, | Jones, C. B. | Cardiff |
| ,, | McLeish, J. A. | Glasgow |
| ,, | Parker, F. | Bradford |
| ,, | Quinney, R. C. | Manchester |
| ,, | Rees, W. D. | Cardiff |
| ,, | Thomson, R. J. | Glasgow |
| ,, | Turton, J. | Huddersfield |
| ,, | Wood, J. | Manchester |

*Higher Grade Certificate in Gas Engineering (Supply)* (25)

| Class. | Name. | Centre. |
|---|---|---|
| First | Ashton, J. E. | Manchester |
| ,, | *Gosling, R. G. | Westminster |
| ,, | Rouse, D. H. | Wandsworth |
| ,, | Stokes, J. L.... | Westminster |
| Second | Basford, T. J. | ,, |
| ,, | Brownlee, J. | Newcastle-upon-Tyne |
| ,, | Burch, G. A. | Westminster |
| ,, | Caswell, T. M. | ,, |
| ,, | Cook, J. B. ... | Wandsworth |
| ,, | Easterbrook, A. G. S. | ,, |
| ,, | Gibbons, S. J. | Westminster |
| ,, | Grimshaw, H. | Manchester |
| ,, | Hayes, D. H. | Westminster |
| ,, | How, C. A. ... | ,, |
| ,, | Johnston, R. E. | ,, |
| ,, | King, S. A. ... | ,, |
| ,, | Kirkbright, R. W. | Bradford |
| ,, | Nangle, J. ... | Manchester |
| ,, | Peters, K. G. | Westminster |
| ,, | Plumpton, R. R. | ,, |
| ,, | Rivkine, J. W. | ,, |
| ,, | West, C. E. C. | ,, |
| ,, | Willgoss, G. E. | ,, |
| ,, | Witt, W. S. | ,, |
| ,, | Wright, S. E. | Newcastle-upon-Tyne |

*Certificate in Gas Supply* (5)

| Class. | Name. | Centre. |
|---|---|---|
| First | Lockwood, F. W. | East Ham |
| Second | Davis, A. W. | ,, |
| ,, | Folkes, V. S. A. | ,, |
| ,, | Ford, M. F. | Liverpool |
| ,, | Foulis, D. ... | ,, |

*Ordinary Grade Certificate in Gas Engineering (Supply)* (31)

| Class. | Name. | Centre. |
|---|---|---|
| First | Andrews, J. O. | Westminster |
| ,, | Brown, G. ... | ,, |
| ,, | Cameron, T. R. | Edinburgh |
| ,, | *Hollom, G. H. | East Ham |
| ,, | Murray, D. ... | Dundee |
| ,, | Patterson, S. K. | Edinburgh |
| ,, | *Procter, J. R. | East Ham |
| ,, | Rodley, A. ... | Southend |
| Second | Assirati, A. F. J. | East Ham |
| ,, | Bache, C. J. ... | Cardiff |
| ,, | Bromley, H. | Manchester |
| ,, | Buchan, A. P. | Kirkcaldy |
| ,, | Dickson, R. R. | ,, |
| ,, | Duncan, A. | ,, |
| ,, | French, A. K. | Westminster |
| ,, | Holden, W. J. | Coventry |
| ,, | Holder, J. ... | Huddersfield |
| ,, | Hyde, W. ... | Liverpool |
| ,, | Limbert, A. ... | Leeds |
| ,, | McLeish, J. A. | Glasgow |
| ,, | McPherson, J. G. C. T. | Dundee |
| ,, | Marfleet, S. L. | Westminster |
| ,, | Marshall, J. C. | Glasgow |
| ,, | Parry, E. I. ... | Liverpool |
| ,, | Pawsey, W. F. | East Ham |
| ,, | Pulley, A. G. | ,, |
| ,, | Seddon, F. | Liverpool |
| ,, | Thomson, R. J. | Glasgow |
| ,, | Tindale, N. B. | Leeds |
| ,, | Wilby, D. H. | Huddersfield |
| ,, | Wilks, N. ... | Bradford |

*Ordinary Grade (Single Subject) Examination in Gas Engineering (Supply) to qualify to sit for the Diploma in Gas Engineering (Manufacture)* (2)

| Class. | Name. | Centre. |
|---|---|---|
| First | Rees, W. D. | Cardiff |
| ,, | Thomas, A. L. | ,, |

* An asterisk against a candidate's name indicates that he has passed with distinction.

## 1940 REPORT OF THE BOARD OF EXAMINERS

The Board of Examiners has pleasure in submitting to the Gas Education Committee, for presentation to the Council of The Institution of Gas Engineers, its Report on the 1940 Examinations held under the Education Regulations of the Institution.

During the year 1939-40, the members of the Board of Examiners and Assessors, appointed by the Council were:—

*Major Courses:*

*Examiners:* E. Crowther, M.Eng., A.M.Inst.C.E. (Newcastle-upon-Tyne), Chairman; G. Dougill, M.Sc., A.I.C. (London); L. P. Ingram, M.Sc., A.I.C. (Loughborough); G. H. Kenyon, M.Sc.Tech. (London); A. Marsden, M.Sc., F.I.C. (Bristol); A. McDonald, B.Sc., A.I.C. (Castleford); H. Moys, B.Sc. (Beckton)—Gas Engineering (Manufacture). W. Dieterichs (London); J. H. Dyde, B.Sc. (London); J. A. Gould, M.C. (London); H. R. Hems (Birmingham); E. F. Keable (Great Yarmouth); A. C. Rea, M.I.Mech.E. (Perth); W. L. S. Spinks (Birmingham); J. E. White (Newcastle-upon-Tyne)—Gas Engineering (Supply).

*Assessors:* England and Wales: A. McDonald, B.Sc., A.I.C. (Castleford)—Gas Engineering (Manufacture); W. A. Bishop (Croydon)—Gas Engineering (Supply). West of Scotland: David Fulton (Helensburgh) and A. S. Nisbet (Paisley)—Gas Engineering (Manufacture) and Gas Engineering (Supply). East of Scotland: D. D. Melvin (Edinburgh) and J. W. Napier, M.B.E. (Alloa)—Gas Engineering (Manufacture) and Gas Engineering (Supply).

*Minor Course and Gas Fitting Courses:*

*Examiners:* E. F. Keable (Great Yarmouth)—Gas Supply Practice; R. N. LeFevre (London), A. G. R. Kennet (Margate) and J. Robertson (London)—Gas Fitting; G. W. Hefford (St. Leonards-on-Sea)—Elementary Science.

E. Crowther (*Chairman, Board of Examiners*).

W. T. K. Braunholtz (*Secretary, The Institution of Gas Engineers*).

*Gas Engineering (Manufacture)—Ordinary Grade*

*External Candidates*

The results of the Ordinary Grade Examinations were disappointing; only 11 out of 24 candidates passed. On the other hand 5 candidates (16·6 per cent) secured first class passes compared with 3 (11·4 per cent) first class passes secured in 1939.

As usual some candidates lost marks through misreading the questions.

Lack of appreciation of proportion in sketching and clear understanding of functions of plant tends to show that some candidates were relying too much on reading and were not making careful observations when on the Works.

*Internal Candidates*

The general standard of the 23 candidates who entered for the Ordinary Grade Examination in Gas Engineering (Manufacture) can only be considered as average. One candidate attained a reasonably high standard but one was distinctly poor.

Several candidates were unable to give lucid descriptions while the accompanying sketches in a number of cases were crude. In one or two instances sketches were very good.

Many explanations were evidently taken from lectures and showed little personal appreciation of the questions involved.

*Gas Engineering (Manufacture)—Higher Grade*

*External and Internal Candidates*

There were 19 external and 32 internal candidates taking the examination this year compared with 24 external candidates in 1939 and 28 in 1938 and with 45 internal candidates in 1939 and 55 in 1938. One must assume that this decrease is due partly to interruption of study caused by increased duties and partly to men being called up for service with the Armed Forces of the Crown.

The standard attained by the external candidates was much better than in the previous two years. Seven candidates (37 per cent) obtained first class passes, including 2 with distinction. Eleven secured second class passes and only 1 failed, compared with 16·7 per cent first class passes in 1939 and 21·4 per cent in 1938. The standard of the internal candidates was disappointing, only 2 (6 per cent) securing first class passes, 23 (72 per cent) secured second class passes, and 7 (22 per cent) failed.

The general standard attained by candidates was fair, although there was a big difference between the average marks obtained by first and second class candidates.

Only 50 per cent of the candidates attempted the question on the control of calorific value of coal gas in relation to combustion characteristics of gas and these answered the question badly, the average mark secured being low.

It would appear that many candidates have not examined the inside of purifiers or their connexions and calculations of size were often hazy.

Many students have apparently not taken much interest in refractory materials and most of those who answered the question made no reference to cements and insulating materials.

Only 19 candidates attempted the question on tar distillation and several candidates confused aliphatic and aromatic hydrocarbons.

*Gas Engineering (Manufacture)—Diploma Grade*

On the whole the papers were well answered, 5 candidates (38 per cent) securing first class passes, 7 secured second class passes, while only 1 candidate failed.

The answers to the one question on manufacture in Part I were disappointing; on the other hand, the first 3 questions were well done, 1 candidate securing full marks for the question on gum formation.

Only 7 candidates attempted the question on welding, but it was encouraging to find that their standard of knowledge was high, indicating first hand experience of welding work.

Some confusion exists between the Reports of the Gas Works Safety Rules Committee and the provisions of the Factories Act, 1937. Candidates would do well to make themselves more familiar with this important Act.

Generally it may be said that candidates have maintained a fair balance between theory and practice in their studies.

*Gas Engineering (Supply)—Ordinary Grade*

*External Candidates*

Thirty-three candidates entered for the examination compared with 27 in 1939; of these 14 secured a first class, including 2 Distinctions, 9 secured a second class and 4 failed, compared with 4 first classes, 14 second classes and no failures in 1939.

The sketching on the whole was good—some very good. Question 3 on governors was answered by only 9 candidates and the answers were poor.

It was disappointing to find that few candidates attempted the question on combustion and these were not at all clear on the subject.

A number of candidates lost marks through misreading the questions, several candidates confusing a water heater with a domestic flueless heater.

*Internal Candidates*

Only 50 internal candidates presented themselves for the Examination in Ordinary Grade Gas Engineering (Supply) compared with 143 in 1938 and 104 in 1939. Twenty (40 per cent) secured a first class pass, including 4 with distinctions, 20 (40 per cent) secured a second class pass and 10 (20 per cent) failed.

The general standard attained was slightly better than in 1939, although one or two papers were notably poor.

It was noted that some students appear to know only one type of multi-point water heater which was referred to by name. This practice is to be deprecated. Again students from another centre had apparently received little or no instruction on the industrial use of gas, since not one of these students attempted the question on the industrial use of gas.

*Certificate in Gas Supply*

*External and Internal Candidates*

Only 8 candidates entered for this examination, 2 secured a first class and 6 a second class.

Only 1 student appeared to have a knowledge of high pressure work. Most candidates had no knowledge of gas analysis by volumetric methods at constant volume.

Fundamentals of gas appliance design were not well answered and few candidates appreciated the significance of the latest developments in gas fires.

It is evident that the study of lighting has been badly neglected: no answers were received to the question on factory lighting and only two answers, both of which were poor, to the other question on lighting.

*Gas Engineering (Supply)—Higher Grade*

*Internal and External Candidates*

Only 33 candidates presented themselves for examination this year compared with 98 in 1939; of the 33, 15 were external and 18 internal.

The standard attained by the candidates generally was disappointing, only 5 (15 per cent) obtained first class passes, 18 (53 per cent) second class and 10 (30 per cent) failed, compared with 20 (20·5 per cent) first class, 51 (52 per cent) second class and 27 (27·5 per cent) failed in 1939. There was, in addition, a big difference between the average mark obtained by first and second class candidates.

Part I was an essentially practical paper and the low marks obtained by a number of candidates indicate either an inability on the part of students to apply their theoretical knowledge to practical problems or lack of tuition and study arising from war conditions.

Knowledge of causes of electrolytic corrosion of gas mains was very sketchy. Boyle's, Charles's and Dalton's laws were not defined precisely and Dalton's Law in particular was not well known.

In Part II only 9 candidates attempted the lighting Question 1; of these only three answers were good, indicating that candidates were competent to plan a factory lighting installation, and only 7 candidates attempted Question 5. It is evident that the study of lighting is not receiving adequate attention.

In Question 3 on water heaters a number of candidates were uncertain about the permissible quantity of carbon monoxide in the products of combustion and the $CO/CO_2$ ratio under overload conditions. Candidates paid too much attention to chemical tests and too little to mechanical efficiency.

*Gas Engineering (Supply)—Diploma Grade*

*External Candidate*

The standard of the answers submitted was below that required for the Higher Grade Examination in Gas Engineering (Supply).

*Gas Supply Practice*

Thirty-two candidates entered for the Examination in Gas Supply Practice, 14 of which secured a first class pass, 11 a second class pass and 7 failed.

The answers reveal that the majority of the students have received a good grounding in their subject and that the questions were fully understood.

The answers were set out much better and were devoid of superfluous matter and generally speaking the sketches were done with reasonable care.

All the questions were answered by a fair proportion of the candidates but Questions 3, 5, and 6 were the least popular.

*Gas Fitting*

*Grade I*

In view of the unusual circumstances prevailing during the past winter session, the examination results can be described as fairly satisfactory. A number of candidates lost marks through confusing volume with area. The hourly consumption of gas appliances also needs careful attention.

*Grade II*

The questions were on the whole answered fairly well but a number of candidates lost marks through not reading the questions carefully; the points covered by the questions all merit careful attention.

*Final Grade*

The general standard of attainment in the Written Papers was somewhat below that of the last year or two. For this examination it must be borne in mind that only one year was spent under the arduous conditions of war-time. The candidates had had four previous normal years. The Written Paper was of a practical nature and was specially designed to act as a complement to the Practical Tests.

The question on governors revealed a fair knowledge of pressure governors but a poor knowledge of the essentials of volume governors.

More attention should be given to purposes served by non-return valves. Candidates who attempted this question understood the operation of the valve but few were thoroughly familiar with its uses.

The answers to simple water heating problems were very disappointing. Few candidates appreciated the undesirability of fitting valves on the type of installation depicted.

## Ropes for Power Drives

An interesting brochure issued by R. & J. Dick, Ltd., of Greenhead Works, Glasgow, deals with the firm's "Dickropes" for power drive purposes. The construction of these ropes has been designed to give long life with high efficiency, while they are claimed to have great flexibility which enables them to be used on small-diameter pulleys. The elasticity retained in the "Dickrope" allows them to deal successfully with shock loads such as are experienced on compressors, planing machines, fans, &c. These ropes are manufactured in six sizes, ranging from $\frac{3}{8}$ in. by $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. by $\frac{7}{8}$ in.

The brochure goes on to tabulate the various sizes of rope in relation to the duties required of them, with particulars of horse-power rating, load factors, correction factors, and overload requirements. Finally are shown a number of photographs of typical "Dickrope" installations together with details of the job. It is emphasized that these ropes should be kept clean and free from oil. No dressing is necessary, but an occasional wipe with benzine prolongs their life. The firm will be glad to quote for any rope drive requirements as well as for pulleys if required.

# Agriculture and Smoke Pollution*

By H. Trefor Jones, Leeds University

THIS Paper is a collection of observations made in the course of advisory work in Yorkshire during the last fifteen years on the effect of smoke fumes on the growth of crops and on the reaction of soils.

As Crowther and Ruston[1,2] have pointed out, smoke adversely affects plant life in three ways:

1. By absorbing solar energy; in the worst cases as much as 40% may be absorbed.
2. By reducing the assimilatory power of the leaves, consequent upon the deposition of soot.
3. By the scorching effect on vegetation of the acids brought down by rain, and the indirect effect of these acids on plants by reducing the lime status of the soil.

Attention will be confined mainly to the last of these factors. One ton of coal contains between 15 and 30 lb. of sulphur, mainly in the form of pyrites; on burning the coal the bulk of this sulphur is discharged into the atmosphere as $SO_2$ and $SO_3$, with about 5% $H_2S$. All these gases eventually reach the soil and become converted into sulphuric acid.

In a town the size of Leeds, domestic chimneys alone contribute about 150 tons of sulphur to the atmosphere every week, the equivalent of nearly a ton of sulphuric acid per acre per annum. Where the concentration of acids is of this order of magnitude it is not surprising that vegetation fails completely, and that metals, wood, and stone corrode rapidly. In cities and towns the domestic chimney is the worst offender; but in the less densely populated industrial districts in the West Riding, the bulk of the sulphurous fumes is contributed by industrial chimneys and by the smouldering pit heaps of collieries.

In the immediate vicinity of a burning pit heap—that is, for a distance of about 50 yards in the direction of the prevailing wind—every form of vegetation is killed, and visible damage to crops may be observed even as far as a mile away, although some fields nearer the heap may appear unaffected.

It is during the dormant months that most of the damage is done; grassland and winter-sown crops like wheat and winter vegetables are the chief sufferers. Unless the concentration of smoke is very high, spring-sown crops survive fairly well; it is, however, unsafe to dress potatoes with copper preparations even under conditions of mild pollution. Barley and sugar beet are rarely grown, but this is due partly to the unsuitability of the soil for these crops.

The symptoms of smoke damage on wheat are, first, the scorching of the tip of the leaf, followed by a yellowing of the remainder of the leaf, which later becomes reddish or purple in colour. The check which the crop thus receives results in uneven ripening, and a poor blackened sample of grain. Vegetables planted in early autumn may fail to survive the winter, and the survivors are of unprepossessing appearance.

The average grass field in the industrial parts of the West Riding is of very inferior quality. This condition is largely due to neglect, but neglect born of the unequal struggle between the farmer and the unnatural conditions.

All trees in a smoke affected area are stunted in growth, and many branches are dead; hedges are in a very poor condition and are kept in repair with a few strands of barbed wire, the maximum life of which is about four years. Creosoted wood forms the most permanent form of fencing.

Similar observations to the above, and many others, are made by Crowther and Steuart[3] in the Journal of Agricultural Science for 1914.

Even where the concentration of smoke is insufficient to cause visible damage to crops there must be a considerable adverse effect on the final yield. Thomas and Hill[4] have found that a concentration of 0·8 parts per million of sulphur dioxide produces no visible effect on the leaves of plants after an exposure of one hour, but reduces their photosynthetic activity by 44%, and respiration by 38%. These processes assume a normal rate soon after the treatment is discontinued. Exposure to a concentration of 5 parts per million of $SO_2$ for one hour causes a complete stoppage of photosynthesis and results in almost entire defoliation. The lower concentration of sulphur dioxide used in these experiments is of the same order of magnitude as that present in a smoke laden atmosphere. (McLachlan[5] reports that the maximum $SO_2$ content of London air in 1935 was 0·658 parts per million.)

Pastures alongside the River Aire, south of Leeds, are threatened by many active and potential sources of smoke; a few of them suffer badly, but they seem to possess very strong recuperative powers, and recover rapidly once the smoke nuisance is abated. In one particular case it was reported that "even if the abnormal conditions cease, it will be necessary either to renovate this pasture with a seeds mixture or to run it through a rotation before sowing down to grass." Within six months the "abnormal conditions" had ceased, due to the closing down of the offending industrial plant.

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3 C. Crowther and D. W. Steuart: *J. Agric. Sci.* (1914), 6, p. 395.
4 M. D. Thomas and G. R. Hill: *Plant. Phys.* (1937), 12, p. 309.
5 T. McLachlan: *J.S.C.I. (R.)*, (1937), 56, p. 98.

* From the current issue of *Smokeless Air*.

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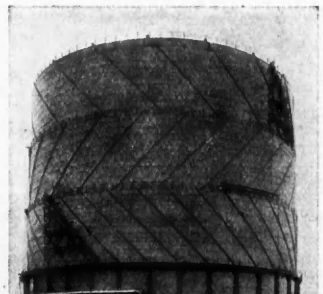

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LONDON
Millwall— Providence Iron Works

483

# Products Prices

## The London Market

July 29.

There is little of interest to record in the values of tar products, present prices being as follows: Owing to absence of demand from the Continent, it is not possible to give a value for pitch; creosote is about 4¾d. to 5d. per gallon, refined tar 3¾d. to 4d. The price of pure toluole under the Ministry of Supply Toluene No. 2 Order, 1940, is 2s. 5d. per gallon, pure benzole 1s. 10d., 95/160 solvent naphtha 1s. 11d. to 2s., and 90/160 pyridine about 18s. 6d., all per gallon naked, refined naphthalene crystals £23 per ton in bags, all *ex* makers' works.

## The Provinces

July 29.

The average prices of gas-works products during the week were: Pitch.* Toluole, naked, North, 1s. 9½d. (Controlled by the Ministry of Supply Order No. 1, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North, 9d. to 9½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 4½d. to 1s. 5½d. Creosote, *ex* works, in bulk, North, liquid and salty, 4½d. to 4¾d.; Scotland, 4¼d. to 4¾d.; low gravity, 4½d. to 4¾d. Fuel Grade, 4d. to 4¼d. Carbolic acid, 60's, 3s. 6d. to 3s. 7½d. Naphthalene, £15 to £20. Salts, 75s. to 85s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal. Heavy oil: Unfiltered anthracene oil, (min. gr. 1,080), 5¼d. to 5½d.; filtered heavy oil (min. gr. 1,080), 5¾d. to 6d.; heavy anthracene oil gr. less than 1,080, 6d. to 6¼d.

* Pitch.—Owing to the Export Trade being at a standstill due to the position in France it is practically impossible at the moment to quote a market price for pitch. For the same reason no quotation can be given for crude gas-works tar.

## Scotland

GLASGOW, July 27.

Most products are in fair request, with prices showing no material alteration on the week's trading.

**Refined tar.**—Home controlled prices are unchanged at 4½d. to 4¾d. per gallon, while for export supplies are available at 3½d. per gallon, both f.o.r. naked.

**Creosote oil.**—A small but steady throughput is maintained in most grades, and prices are as under: Specification oil, 5d. to 5¼d. per gallon; low gravity, 6d. to 6½d. per gallon; neutral oil, 5¾d. to 6d. per gallon; all *ex* Works in bulk.

**Cresylic acid.**—Demand is rather poor, and supplies are available at the following prices: Pale 97/99%, 1s. 11d. to 2s. 1d. per gallon; Pale 99/100%, 2s. 3d. to 2s. 5d. per gallon; Dark 97/99%, 1s. 8d. to 1s. 10d. per gallon; all *ex* Works in buyers' packages.

**Crude naphtha** is called 6½d. to 7½d. per gallon, *ex* Works in bulk, according to quality.

**Solvent naphtha.**—90/160 grade is now valued at 1s. 8½d. to 1s. 9d. per gallon, but 90/190 heavy naphtha is unchanged at 1s. 4½d. to 1s. 5½d. per gallon.

**Motor benzole** remains at 1s. 8d. to 1s. 8½d. per gallon.

**Pyridine.**—90/160 grade is 17s. to 18s. per gallon, and 90/140 grade is 19s. to 20s. per gallon.

# Contracts Advertised

**Resetting Retorts.**
Brighouse Gas Depart. [p. 214.]

**Stores.**
Bradford Gas Depart. [p. 214.]

# Dividends Announced

## Gas Light and Coke

The Directors of the Gas Light & Coke Company have declared dividends for the half-year ended June 30 last as follows: On the 4% consolidated preference stock at the rate of £4% per annum; on the 3¼% redeemable preference stock, 1970, at the rate of £3 15s.% per annum; on the 3½% maximum stock at the rate of £3 10s.% per annum; on the ordinary stock at the rate of £4 10s.% per annum.

## South Metropolitan

The Directors of South Metropolitan Gas Company have declared an interim dividend of 2% actual, less tax, on the ordinary stock for the six months ended June 30, 1940. Dividend Warrants will be posted on Sept. 2. This Dividend compares with 2½% paid last year.

## South Suburban

The Directors of the South Suburban Gas Company announce the declaration of an interim dividend on the ordinary stock at the rate of 2%. This compares with a rate of 3% a year ago.

## Newcastle

The Directors of the Newcastle-upon-Tyne and Gateshead Gas Company have declared interim dividends at the rate of 2% on the preference stock and 2½% on the ordinary stock, payable on Aug. 23. These are at the same rates as last year.

# Gas Undertakings Results

## Boston

The report submitted to the recent annual meeting of the Boston Gas Light and Coke Company stated that the net profit on the working during the past twelve months was £5,792. The dividend for the year on the old ordinary shares is £10 4s.%, and on the new ordinary shares £8 8s.%. An amount of £275 is transferred to the Reserve Fund, in accordance with the Boston Gas Order, 1929, leaving a balance of £5,687 to be carried forward to next year's account. A decrease in gas rental has been due mainly to a reduction in price. During the year the number of ordinary and prepayment meters fixed increased by 64, to a total of 7,889. It is regarded as highly satisfactory that the Company have got through nine months' working under war conditions without varying the reduction in the selling price of gas announced at the meeting a year ago, and are proposing for the present to carry on at the existing price. The quantity of gas sold in the past year was practically the same as in the preceding twelve months.

## Oldham

The Oldham Corporation Gas-Works completed the year to March 31 with a net deficiency of £3,592, which has been increased by the contribution to the Borough Fund of £4,000 to the sum of £7,592. Heavy increases in costs, and possible further rises, necessitated an all-round increase of 6d. per 1,000 cu.ft. in the price of gas as from the final meter reading in the December quarter. One factor which has swollen costs has been the extraordinarily severe winter, which necessitated considerable expense in making good the damage. The total consumption of gas in houses and shops, mills, and workshops was 1,269,035,500 cu.ft., as compared with 1,188,448,100 cu.ft. during the preceding year. Thus there has been an increase in the quantity consumed in houses and shops of 22,183,300 cu.ft., and an increase in the case of mills and workshops of 58,404,100 cu.ft. The total number of meters fixed on March 31 last was 67,927 (46,425 of them prepayment); the actual number of consumers having gone up from 61,852 to 61,902. The quantity of gas consumed by public lamps during the past year shows a decrease on twelve months ago of 85,080,000 cu.ft.


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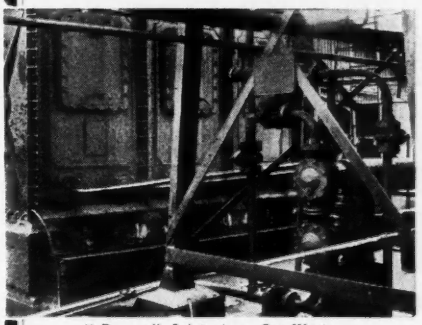
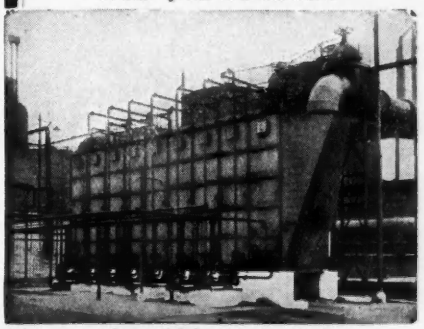
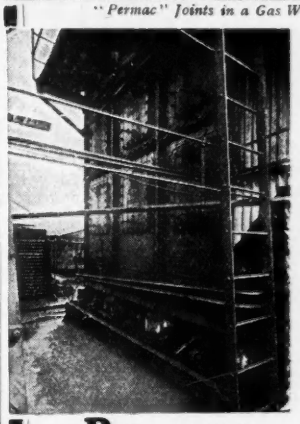
METAL-TO-METAL JOINTING MATERIAL.



"Permac" Joints in a Gas Works



"Permac" Joints in a Gas Works.



"Permac" Joints in a Gas Works.

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# GAS STOCKS AND SHARES

Since the heavier taxation foreshadowed for the Supplementary Budget did not wholly materialize, the Stock Exchange took on a more cheerful tone, and for the present at any rate business is improving and prices are on the upgrade. British Funds continued very firm last week, and the majority closed fractionally higher—2½% Consols being ½ up at 72½. The home railway dividends gave satisfaction, and some good price improvements took place. The industrial section also shared in the better conditions, and with the market short of supplies, the small buying movement which set in caused some sharp rises in prices, especially among tobacco shares, which had previously declined as a result of an anticipated higher tax on the commodity. Oil and rubber shares also came into the picture, and more activity took place among gold mining shares.

The volume of business in the Gas Market was on the light side, but a few stocks showed improvement, and the number of downward price changes was considerably less than during the past few weeks. Gas Light units went ahead again and closed 6d. higher at 13s. 3d. South Metropolitan also showed further appreciation with a rise of 3 points to 44½. Imperial Continental, after a long period of almost weekly depreciations, moved up 2 points to 35. On the Provincial Exchanges it will be noticed that Newcastle units again reacted, closing 1s. down at 15s. 6d., and Sunderland dropped 2½ points to 109½. Except for one *ex* div. marking there were no changes in the Supplementary List. Although there does not appear to be any stock available at the time of writing, a standing order for a parcel of Commercial stock at round about 40 might well turn out a profitable bargain, and at this price the yield works out at 7½% on a 3% dividend basis.

Two important interim dividend announcements were made during the week—*viz.*, the Gas Light and Coke Company, which is distributing 2¼%, against £2 16s.% a year ago, while the South Metropolitan Company is paying 2% against 2½%.

## Official Quotations on the London Stock Exchange

| Issue. £ | When ex-Dividend. | Dividends. Prev. Hf. Yr. % p.a. | Dividends. Last Hf. Yr. % p.a. | NAME. | Quotations July 26. | Rise or Fall on Week. |
|---|---|---|---|---|---|---|
| 1,767,439 | Mch. 11 | 8 | 7 | Alliance & Dublin Ord. ... | 90—100 | ... |
| 374,000 | July 1 | 4 | 4 | Do. 4 p.c. Deb. ... | 90—95 | ... |
| 957,608 | May 13 | 5 | 5 | Asscd. Gas & Water U'd'ts Ord. | 12/—14/- | ... |
| 500,000 | " | 4½ | 4½ | Do. 4½ p.c. Red. Cum. Pref. | 15/6—17/6 | ... |
| 535,545 | " | 4 | 4 | Do. 4 p.c. Red. Cum. Pref. | 14/6—16/6 | ... |
| 336,646 | " | 4 | 4 | Do. 4 p.c. Irred. Cum. Pref. | 12/6—14/6 | ... |
| 750,000 | Mch. 18 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 82—87 | ... |
| 560,070 | Feb. 19 | 7 | 7 | Barnet Ord. 7 p.c. ... ... | 115—120 | ... |
| 300,000 | Apl. 8 | 1/4⅜ | 1/9⅜ | Bombay, Ltd. ... ... ... | 19/6—21/6 | ... |
| 181,915 | Feb. 26 | 9½ | 9½ | Bournemouth Sliding Scale ... | 145—150 | ... |
| 690,526 | " | 7 | 7 | Do. 7 p.c. max. ... | 117—122 | ... |
| 493,960 | " | 6 | 6 | Do. 6 p.c. Pref. ... | 115—120 | ... |
| 50,000 | June 17 | 3 | 3 | Do. 3 p.c. Deb. ... | 65—70 | ... |
| 362,025 | " | 4 | 4 | Do. 4 p.c. Deb. ... | 90—95 | ... |
| 335,000 | " | 5 | 5 | Do. 5 p.c. Deb. ... | 95—100 | ... |
| 357,900 | Feb. 19 | 7½ | 6⅞ | Brighton, &c., 6 p.c. Con. ... | 100—105 | ... |
| 659,955 | " | 6⅞ | 5⅞ | Do. 5 p.c. Con. ... | 85— 90 | ... |
| 205,500 | " | 6 | 6 | Do. 6 p.c. 'B' Pref. ... | 103—108 | ... |
| 855,000 | Mch. 11 | 7 | 8 | British Ord. ... ... | 82—92 | ... |
| 100,000 | June 17 | 7 | 7 | Do. 7 p.c. Pref. ... ... | 115—120 | +3 |
| 350,000 | " | 5½ | 5½ | Do. 5½ p.c. 'B' Cum. Pref. | 110—115 | ... |
| 120,000 | " | 4 | 4 | Do. 4 p.c. Red. Deb. | 75—80 | ... |
| 450,000 | " | 5 | 5 | Do. 5 p.c. Red. Deb. | 93—98 | ... |
| 100,000 | 22 May '33 | 6 | 4 | Cape Town, Ltd. ... ... | ⅛—¼ | ... |
| 100,000 | 6 Nov. '33 | 4½ | 4½ | Do. 4½ p.c. Pref. ... ... | 1—1⅛ | ... |
| 150,000 | June 17 | 4½ | 4½ | Do. 4½ p.c. Deb. ... ... | 52—57 | ... |
| 626,860 | July 15 | 5 7/10 | 6 | Cardiff Con. Ord. ... ... | 89—94 | ... |
| 237,860 | June 17 | 5 | 5 | Do. 5 p.c. Red. Deb. ... | 95—100 | ... |
| 98,936 | Apl. 8 | 2/— | 2/- | Colombo Ord. ... ... ... | 1½—1¾ | ... |
| 24,510 | " | 1/4⅜ | 1/4⅜ | Do. 7 p.c. Pref. ... ... | 19/6—21/6 | ... |
| 739,453 | Mch. 26 | -/11.48 | -/11.48 | Colonial Gas Assn. Ltd. Ord. ... | 14/6—16/6 | ... |
| 296,144 | " | 1/3.30 | 1/3.30 | Do. 8 p.c. Pref. ... ... | 20/—22/- | ... |
| 1,748,935 | July " | 22 | 2 | Commercial Ord. ... | 37—42* | ... |
| 140,000 | Feb. 19 | 4 | 4 | Do. 4 p.c. Red. Pref. ... | 87—92 | ... |
| 620,000 | June 10 | 3 | 3 | Do. 3 p.c. Deb. ... ... | 58—63 | ... |
| 286,344 | Feb. 19 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 88—93 | −2 |
| 200,000 | " | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 90—95 | ... |
| 807,560 | Feb. 12 | 7 | 7 | Croydon sliding scale ... ... | 88—93 | −2½ |
| 644,590 | " | 5 | 5 | Do. max. div. ... ... | 82—87 | ... |
| 620,385 | July 1 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 90—95 | ... |
| 208,660 | Feb. 19 | 5 | 5 | Dudley, Brierley Hill & Dist. Ord. | 98—103 | ... |
| 82,275 | " | 5 | 5 | Do. 5 p.c. Con. Pref. ... | 93—98 | ... |
| 79,000 | " | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 93—98 | ... |
| 239,000 | Jan. 29 | 5 | 88/6 | East Hull Ord. 5 p.c. ... ... | 70—80 | ... |
| 187,215 | Feb. 12 | 5⅝ | 5⅝ | East Surrey Ord. 5 p.c. ... | 93—98 | ... |
| 176,211 | June 17 | 5 | 5 | Do. 5 p.c. Deb. ... | 90—95 | −2 |
| 250,000 | July 8 | 4 | 6 | Gas Consolidation Ord. 'B' ... | 13/—15/- | ... |
| 250,000 | May 13 | 4 | 4 | Do. 4 p.c. Red. Cum. Pref. | 15/—17/- | ... |
| 19,152,410 | Jan. 29 | 5⅜ | 3⅜ | Gas Light & Coke Ord. ... | 12/9—13/9a | +-/6 |
| 2,600,000 | " | 3½ | 3½ | Do. 3½ p.c. max. ... ... | 55—60 | ... |
| 4,477,106 | " | 4 | 4 | Do. 4 p.c. Con. Pref. ... | 77—82 | ... |
| 2,993,000 | July 8 | 3½ | 3½ | Do. 3½ p.c. Red. Pref. ... | 78—83 | ... |
| 8,602,497 | June 3 | 3 | 3 | Do. 3 p.c. Con. Deb. ... | 62—67 | ... |
| 3,642,770 | " | 5 | 5 | Do. 5 p.c. Red. Deb. ... | 99—104 | ... |
| 3,500,000 | " | 4½ | 4½ | Do. 4½ p.c. Red. Deb. ... | 95—100 | ... |
| 700,000 | Mch. 11 | 3½ | 3½ | Do. 3½ p.c. Red. Ded. ... | 80—85 | ... |
| 270,466 | Feb. 19 | 6 | 6 | Harrogate New Cons. ... ... | 93—98 | ... |
| 157,500 | Apl. 8 | ‡1/- | ‡1/- | Hong Kong and China Ord. ... | ½—¾ | ... |
| 5,600,000 | May 13 | 4 | 8 | Imperial Continental Cap. ... | 30—40 | +2 |
| 172,810 | Jan. 29 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 64—69 | ... |
| 63,480 | June 24 | 3 | 3 | Maidstone 3 p.c. Deb. ... ... | 54—59 | ... |
| 45,000 | June 10 | †8 | †10 | Malta & Mediterranean ... | 88—98 | ... |
| 392,000 | Apl. 1 | 5½ | 5½ | Metropolitan (of Melbourne) ... 5½ p.c. Red. Deb. ... ... | 95—100 | ... |
| 231,977 | Feb. 19 | 5 | 5 | M.S. Utility 'C' Cons. ... ... | 75—80 | ... |
| 968,658 | " | 4 | 4 | Do. 4 p.c. Cons. Pref. ... | 77—82 | ... |
| 390,076 | June 24 | 4 | 4 | Do. 4 p.c. Deb. ... | 85—90 | ... |

| Issue. £ | When ex-Dividend. | Dividends. Prev. Hf. Yr. % p.a. | Dividends. Last Hf. Yr. % p.a. | NAME. | Quotations July 26. | Rise or Fall on Week. |
|---|---|---|---|---|---|---|
| 148,955 | June 24 | 5 | 5 | M.S. Utility 5 p.c. Deb. ... | 95—100 | ... |
| 125,000 | July 1 | 3½ | 3½ | Do. 3½ p.c. Red. Bds. ... | 87—92 | ... |
| 675,000 | May 6 | †4 | †4 | Montevideo, Ltd. ... ... | 55—60 | ... |
| 250,000 | Mch. 18 | 7½ | 5 7/10 | North Middlesex 6 p.c. Con. ... | 103—108 | ... |
| 396,160 | Jan. 29 | 5 | 5 | Northampton 5 p.c. max. ... | 97—102 | ... |
| 300,000 | Apl. 29 | 9 | 7 | Oriental, Ltd. ... ... ... | 108—113 | ... |
| 468,537 | June 3 | 7 | 8 | Plymouth & Stonehouse 5 p.c. | 95—105 | ... |
| 621,667 | Feb. 5 | 8½ | 8½ | Portsmouth & Gosport Cons. | 100—105 | ... |
| 241,446 | " | 5 | 5 | Do. 5 p.c. max. ... ... | 73—78 | −2 |
| 73,350 | " | 5 | 5 | Do. 5 p.c. Pref. ... ... | 87—92 | ... |
| 75,000 | " | 4 | 4 | Do. 4 p.c. Pref. ... ... | 70—75 | ... |
| 114,000 | Feb. 5 | 5 | 5 | Preston 5 p.c. Pref. ... | 88—93 | ... |
| 247,966 | June 17 | 4 | 4 | Primitiva 4 p.c. Cons. Deb. ... | 91—96 | ... |
| 625,959 | July 15 | 4 | 4 | Do. 4 p.c. Red. Deb. ... | 90—95 | ... |
| 15,000 | Mch. 11 | 6 | 6 | San Paulo 6 p.c. Cum. Pref. ... | 4½—6½ | ... |
| 441,275 | Apl. 29 | 1/1½ | 1/1½ | Severn Val. Gas Cor. Ld. Ord. | 14/—16/- | ... |
| 460,810 | Mch. 11 | -/10½ | -/10½ | Do. 4½ p.c. Cum. Pref. ... | 16/—18/- | ... |
| 133,201 | Feb. 12 | 8½ | 5 | Shrewsbury 5 p.c. Ord. ... | 105—115 | ... |
| 9,000 | June 17 | †4 | †5 | South African Ord. ... ... | 3½—4½ | ... |
| 1,996,297 | Apl. 29 | 1/2⅜ | 1/ | South East'n Gas Cn. Ld. Ord. | 11/—13/- | ... |
| 1,000,000 | Mch. 4 | -/10½ | -/10½ | Do. 4½ p.c. Red. Cum. Pref. | 14/—16/- | ... |
| 769,191 | " | 4 | 4 | Do. 4 p.c. Cum. Pref. ... | 13/—15/- | ... |
| 450,000 | Feb. 12 | 4 | 4 | Do. 4 p.c. Red. Deb. ... | 95-100 | ... |
| 150,000 | " | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 89—94 | ... |
| 6,709,895 | " | 5 | 4 | South Met. Ord. ... ... | 42—47 | +3 |
| 1,135,812 | " | 6 | 6 | Do. 6 p.c. Irred. Pref. ... | 100—110 | ... |
| 850,000 | " | 4 | 4 | Do. 4 p.c. Irred. Pref. ... | 72—77 | ... |
| 1,895,445 | July 1 | 3 | 3 | Do. 3 p.c. Deb. ... ... | 60—65 | ... |
| 1,000,000 | July 15 | 5 | 5 | Do. 5 p.c. Red. Deb. ... | 95—100 | ... |
| 600,000 | " | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 91—96 | ... |
| 1,543,795 | July 22 | 3 | 4 | South Suburban Ord. 5 p.c. ... | 60—70* | ... |
| 512,925 | July 8 | 5 | 5 | Do. 5 p.c. Pref. ... ... | 88—93 | ... |
| 500,000 | " | 4 | 4 | Do. 4 p.c. Pref. ... ... | 71—76 | ... |
| 250,000 | " | 3½ | 3½ | Do. 3½ p.c. Red. Pref. ... | 80—85 | ... |
| 888,587 | June 10 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 95—100 | ... |
| 250,000 | " | 4 | 4 | Do. 4 p.c. Deb. ... ... | 85—90 | ... |
| 200,000 | Feb. 12 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 87—92 | ... |
| 427,859 | Apl. 15 | -/9⅜ | 1/2⅜ | S. Western Gas & Water Ord. | 13/—15/- | ... |
| 160,523 | " | -/10½ | -/10½ | Do. 4½ p.c. Red. Cum. Pref. | 15/—17/- | ... |
| 110,000 | June 17 | 4 | 4 | Do. 4 p.c. Red. Deb. ... | 85—97 | ... |
| 180,000 | " | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 82—87 | ... |
| 750,541 | Feb. 5 | 5 | 5½ | Southampton Ord. 5 p.c. ... | 73—78 | ... |
| 148,836 | June 17 | 4 | 4 | Do. 4 p.c. Deb. | 82—87 | ... |
| 350,000 | Feb. 12 | 5½ | 5½ | Swansea 5½ p.c. Red. Pref. ... | 97—102 | ... |
| 200,000 | June 24 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 85—95 | ... |
| 1,076,490 | Feb. 26 | 6½ | 5 | Tottenham and District Ord.... | 75—85 | −5 |
| 409,835 | " | 5½ | 5½ | Do. 5½ p.c. Pref. ... ... | 100—105 | ... |
| 62,235 | " | 5 | 5 | Do. 5 p.c. Pref. ... ... | 90—95 | ... |
| 453,380 | June 10 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 82—87 | +2 |
| 1,247,505 | May 20 | 4 | 6 | U. Kingdom Gas Cor. Ord. ... | 12/6—14/6 | ... |
| 1,085,952 | May 13 | 4½ | 4½ | Do. 4½ p.c. 1st Cum. Pref. ... | 14/—16/- | ... |
| 772,709 | " | 4 | 4 | Do. 4 p.c. 1st Red. Cum. Pf. | 14/—16/- | ... |
| 745,263 | June 17 | 4½ | 4½ | Do. 4½ p.c. 2nd Non-Cum. Pf. | 12/6—14/6 | ... |
| 1,093,656 | Mch. 18 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 83—88 | ... |
| 378,106 | Mch. 11 | 7 | 7 | Uxbridge, &c., 5 p.c. ... ... | 95—100 | ... |
| 133,010 | " | 5 | 5 | Do. 5 p.c. Pref. ... | 95—100 | ... |
| 1,371,138 | July 8 | 3½ | 4 | Wandsworth Consolidated ... | 62—72 | ... |
| 2,525,768 | " | 4 | 4 | Do. 4 p.c. Pref. ... ... | 71—76 | ... |
| 1,343,964 | June 17 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 90—95 | ... |
| 383,745 | " | 4 | 4 | Do. 4 p.c. Deb. ... ... | 80—85 | ... |
| 400,000 | " | 3⅜ | 3⅜ | Do. 3⅜ p.c. Red. Deb. ... | 87—92 | ... |
| 558,342 | July 15 | 6 | 5 | Watford and St. Albans Ord. ... | 88—93 | ... |
| 200,000 | " | 5 | 5 | Do. 5 p.c. Pref. ... ... | 87—92 | ... |
| 200,000 | " | 5½ | 5½ | Do. 5½ p.c. Pref. ... ... | 97—102 | ... |
| 200,000 | " | 4 | 4 | Do. 4 p.c. Rd. Pf. (1973/8) | 85—90 | ... |
| 100,000 | " | 4 | 4 | Do. 4 p.c. Red. Pf. (1959) | 91—96 | ... |
| 209,000 | June 10 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 85—90 | ... |

a.—The quotation is per £1 of Stock. * Ex. Div. † Paid free of income-tax. ‡ For year. § Actual.

**Supplementary List and Provincial Exchanges overleaf.**

# STOCK AND SHARE LIST—Contd.

## Supplementary List, not Officially Quoted, London

| Issue. £ | When ex-Dividend. | Dividends. Prev. Hf. Yr. % p.a. | Dividends. Last Hf. Yr. % p.a. | NAME. | Nominal Quotations July 26. | Rise or Fall on Week. |
|---|---|---|---|---|---|---|
| 202,152 | Mch. 18 | 5 | 5 | Ascot Ord. ... ... | 80—85 | ... |
| 128,182 | Dec. 27 | 5 | 5 | Do. 5 p.c. Pref. ... | 85—90 | ... |
| 31,035 | Mch. 4 | -/9 3/8 | -/9 3/8 | Associated Utilities 4 p.c. Pref. | 15/—17/- | ... |
| 100,000 | June 24 | 3½ | 3½ | Do. 3½ p.c. Red. Deb. ... | 87—92 | ... |
| 17,000 | Feb. 19 | 8 | 8 | Bognor Orig. Ord. 'A' ... | 102—112 | ... |
| 62,210 | ,, | 8 | 8 | Do. New Add. 'A' ... | 102—112 | ... |
| 87,160 | ,, | 7 | 7 | Do. New 7 p.c. max. ... | 95—105 | ... |
| 37,440 | Jan. 29 | 10 | 10 | Cam. Univ. & Town 10 p.c. max. | 145—155 | ... |
| 125,970 | ,, | 7 | 7 | Do. 7 p.c. max. ... ... | 100—110 | ... |
| 39,025 | ,, | 5 | 5 | Do. 5 p.c. max. ... ... | 80—90 | ... |
| 96,410 | July 15 | 4½ | 4½ | Cardiff 4½ p.c. Pref. ... ... | 85—90 | ... |
| 55,520 | Feb. 19 | 6 | 6 | Colchester 6 p.c. Pref. ... ... | 100—105 | ... |
| 90,550 | Mch. 18 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 95—100 | ... |
| 150,000 | Feb. 12 | 4 | 4 | Croydon 4 p.c. Pref. ... ... | 77—82 | ... |
| 130,000 | July 1 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 82—87 | ... |
| 65,000 | Mch. 4 | 7½ | 6 7/8 | Eastbourne 'A' 5 p.c. ... ... | 100—105 | ... |
| 198,000 | ,, | 6 | 5 3/8 | Do. 'B' 3½ p.c. ... ... | 78—83 | ... |
| 112,312 | ,, | 5 | 5 | Do. 5 p.c. Pref. ... ... | 90—95 | ... |
| 130,000 | June 24 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 95—100 | ... |
| 130,500 | Feb. 19 | 7½ | 7½ | Exeter New Ord. (£10) ... | 12—14 | ... |
| 24,000 | Aug. 21 | 8½ | 8½ | Gt. Yarmouth 8½ p.c. max. (£30) | 15—20 | ... |
| 59,400 | ,, | 7½ | 7½ | Do. 7½ p.c. max. (£30) ... | 10—15 | ... |
| 51,160 | June 10 | 5½ | 5½ | Do. 5½ p.c. Deb. ... ... | 100—105 | ... |
| 152,600 | Feb. 26 | 8 | 9 | Guildford Cons. ... ... | 110—120 | ... |
| 54,055 | ,, | 5 | 5 | Do. 5 p.c. Pref. ... ... | 90—95 | ... |
| 68,250 | June 17 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 95—100 | ... |
| 156,600 | Feb. 19 | 7 | 5 | Hampton Court Cons. ... | 75—85 | ... |
| 86,046 | June 17 | 5 | 5 | Holyh'd&N.W.G.&W.Cpn.Ord. | 13/—15/- | ... |
| 80,000 | Feb. 12 | 4 | 4 | Lea Bridge 4 p.c. Pref. ... ... | 75—80 | ... |
| 60,000 | ,, | 6 | 6 | Do. 6 p.c. Pref. ... ... | 105—115 | ... |
| 94,876 | June 17 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 80— 85 | ... |
| 73,620 | Mch. 18 | 8½ | 8½ | Luton Cons. 'A' ... ... ... | 115—125 | ... |
| 107,960 | Feb. 26 | 4 | 5½ | Mid Kent Ord. (£10) ... ... | 7½—8½ | ... |
| 230,940 | Feb. 5 | 10 | 10 | Oxford & District Ord. ... | 135—145 | ... |
| 47,112 | ,, | 5 | 5 | Do. 5 p.c. Pref. ... ... | 85—90 | ... |
| 50,000 | ,, | 6 | 6 | Do. 6 p.c. Red. Pref. ... | 100—105 | ... |
| 126,193 | May 13 | 7½ | 7½ | Peterborough Ord. ... ... | 138—148 | ... |
| 64,990 | Mch. 18 | 7 | 7 | Redditch Ord. ... ... ... | 100—110 | ... |
| 166,850 | Feb. 19 | 8 | 8 | Romford Ord. ... ... ... | 100—110 | ... |
| 60,000 | ,, | 4 | 4 | Do. 4 p.c. Pref. ... ... | 85—90 | ... |
| 44,000 | Mch. 18 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 95—100 | ... |
| 25,570 | Feb. 12 | 5½ | 5½ | Rugby 5½ p.c. Pref. ... ... | 100—110 | ... |
| 25,000 | ,, | 6 | 6 | Do. 6 p.c. Red. Pref. ... | 100—105 | ... |
| 142,750 | Dec. 11 | 5½ | 5½ | Do. 5½ p.c. Deb. ... ... | 102—107 | ... |
| 110,950 | Feb. 26 | 8 | 8 | Ryde Ord. ... ... ... | 100—110 | ... |
| 270,086 | Mch. 18 | 7 | 7 | Slough Ord. ... ... ... | 98—103 | ... |
| 21,000 | June 10 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 95—100 | ... |
| 28,872 | May 13 | 5½ | 5½ | S. Midland Gas Cpn. Ltd. Ord. | 14/—16/- | ... |
| 28,866 | Mch. 18 | 4½ | 4½ | Do. 4½ p.c. Red. Cum. Pref. | 14/—16/- | ... |
| 127,228 | Feb. 19 | 5 | 7 | Swindon Cons. ... ... ... | 75—80 | ... |
| 60,425 | June 24 | 5 | 5 | Do. 5 p.c. Deb. ... ... | 90—95 | ... |
| 64,380 | June 17 | 5 | 5 | Torquay & Paignton 5 p.c. Pref. | 83—88 | ... |
| 130,000 | Feb. 12 | 5 | 5 | Wakefield Ord ... ... ... | 85—95 | ... |
| 81,650 | ,, | 5 | 5 | Do. 5 p.c. max. ... ... | 75—80 | ... |
| 82,000 | July 22 | 6 | 6 | Weymouth Ord. ... ... | 80—85* | -2 |
| 273,626 | Feb. 12 | 7 | 7 | Wolverhampton Cons. Ord. ... | 115—120 | ... |
| 98,384 | ,, | 6 | 6 | Do. 6 p.c. Pref. ... ... | 105—115 | ... |
| 160,000 | June 17 | 5½ | 5½ | Do. 5½ p.c. Red. Deb. ... | 98—103 | ... |
| 106,490 | Mch. 18 | 5½ | 5½ | Wrexham Ord ... ... ... | 75—85 | ... |
| 90,000 | June 24 | 5 | 5 | York 5 p.c. Red. Deb. ... ... | 94—99 | ... |
| 133,640 | Feb. 19 | 6 | 6 | Yorktown (Cam.) 5 p.c. Cons. | 82—87 | ... |
| 120,000 | ,, | 5 | 5 | Do. 5 p.c. Pref. ... ... | 85—90 | ... |
| 35,000 | June 17 | 5½ | 5½ | Do. 5½ p.c. Deb. ... ... | 103—108 | ... |

## BRISTOL EXCHANGE

| Issue. £ | When ex-Dividend. | Dividends. Prev. Hf. Yr. % p.a. | Dividends. Last Hf. Yr. % p.a. | NAME. | Quotations July 26. | Rise or Fall on Week. |
|---|---|---|---|---|---|---|
| 347,756 | Feb. 1 | 5 | 6 | Bath Cons. ... ... ... | 100—105 | ... |
| 1,667,250 | July 15 | 5 | 5 | Bristol, 5 p.c. max. ... ... | 88—91 | ... |
| 120,420 | June 17 | 4 | 4 | Do. 1st 4 p.c. Deb. ... ... | 94—96 | ... |
| 415,250 | ,, | 4 | 4 | Do. 2nd 4 p.c. Deb. ... | 92—95 | ... |
| 328,790 | ,, | 5 | 5 | Do. 5 p.c. Deb. ... ... | 108—111 | ... |
| 274,000 | Feb. 26 | 5 | 5 | Newport (Mon.) Ord.... ... | 91—94 | ... |
| 13,200 | Mch. 26 | 7 | 8¾ | Pontyp'l Gas & W. 10 p.c. 'A' | 11½—12½ | ... |
| 13,600 | ,, | 5 | 6 | Do. 7 p.c. 'B' ... ... | 9½—10½ | ... |
| 40,000 | ,, | 5 | 6 | Do. 7 p.c. 'C' ... ... | 9½—10½ | ... |
| 140,778 | Feb. 12 | 5 | 5 | Weston-super-Mare Cons. ... | 88—92 | ... |
| 64,338 | Dec. 27 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 90—95 | ... |
| 33,340 | ,, | 7½ | 7½ | Do. 7½ p.c. Deb. ... ... | 140—150 | ... |

## LIVERPOOL EXCHANGE

| Issue. £ | When ex-Dividend. | Dividends. Prev. Hf. Yr. % p.a. | Dividends. Last Hf. Yr. % p.a. | NAME. | Quotations July 26. | Rise or Fall on Week. |
|---|---|---|---|---|---|---|
| 157,150 | Feb. 5 | 5 | 6½ | Chester 5 p.c. Ord. ... ... | 98—101 | ... |
| 92,500 | June 17 | 4 | 4 | Do. 4 p.c. Pref. ... ... | 80—85 | -2½ |
| 36,430 | ,, | 3½ | 3½ | Do. 3½ p.c. Deb. ... ... | 84—87 | ... |
| 41,890 | ,, | 4 | 4 | Do. 4 p.c. Red. Deb. ... | 94—98 | ... |
| 2,167,410 | Feb. 19 | 6 | 6 | Liverpool 5 p.c. Ord. ... ... | 98—100 | 2 |
| 245,500 | June 17 | 5 | 5 | Do. 5 p.c. Red Pref. ... | 99½—102½ | ... |
| 306,083 | July 15 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 99—101* | ... |
| 106,280 | Feb. 5 | 10 | 8 | Preston 'A' 10 p.c. ... ... | 160—170 | ... |
| 188,219 | ,, | 7 | 7 | Do. 'B' 7 p.c. ... ... | 115—125 | ... |

## NEWCASTLE EXCHANGE

| Issue. £ | When ex-Dividend. | Dividends. Prev. Hf. Yr. % p.a. | Dividends. Last Hf. Yr. % p.a. | NAME. | Quotations July 26. | Rise or Fall on Week. |
|---|---|---|---|---|---|---|
| 122,577 | Feb. 19 | 7 | 7 | Blyth 5 p.c. Ord. ... ... | 113—118 | ... |
| 732,000 | Feb. 19 | 4 | 4 | Hartlepool G. & W. Co. & New | 65—68 | ... |
| 2,430,267 | Feb. 5 | 5 | 5 7/10 | Newcastle & Gateshead Con. | 14/6—16/6a | -1/- |
| 682,856 | ,, | 4 | 4 | Do. 4 p.c. Pref. ... ... | 77—82 | -3 |
| 776,706 | Dec. 27 | 3½ | 3½ | Do. 3½ p.c. Deb. ... ... | 80—85 | ... |
| 277,285 | April 24 | 5 | 5 | Do. 5 p.c. Deb. '43 ... | 97—102 | ... |
| 332,351 | Feb. 5 | 6 | 6 | Sunderland 6 p.c. max. ... | 107—112 | -2½ |

## NOTTINGHAM EXCHANGE

| Issue. £ | When ex-Dividend. | Dividends. Prev. Hf. Yr. % p.a. | Dividends. Last Hf. Yr. % p.a. | NAME. | Quotations July 26. | Rise or Fall on Week. |
|---|---|---|---|---|---|---|
| 542,270 | Feb. 12 | 6 | 9 | Derby Con. ... ... ... | 103—108 | ... |
| 55,000 | June 10 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 96—102 | ... |
| 20,000 | June 24 | 5 | 5 | Long Eaton 5 p.c. Pref. ... | 9—11 | ... |
| 80,000 | June 24 | 5 | 5 | Do. 5 p.c. Deb. ... | 100—105 | ... |

## SHEFFIELD EXCHANGE

| Issue. £ | When ex-Dividend. | Dividends. Prev. Hf. Yr. % p.a. | Dividends. Last Hf. Yr. % p.a. | NAME. | Quotations July 26. | Rise or Fall on Week. |
|---|---|---|---|---|---|---|
| 10,000 | Feb. 19 | 10 | 10 | Great Grimsby 'A' Ord. ... | 170—180 | ... |
| 6,500 | ,, | 10 | 10 | Do. 'B' Ord. ... | 170—180 | ... |
| 79,000 | ,, | 10 | 10 | Do. 'C' Ord. ... | 160—170 | ... |
| 1,806,339 | Feb. 26 | 6½ | 6½ | Sheffield Cons. ... ... ... | 119—122 | ... |
| 95,000 | July 8 | 4 | 4 | Do. 4 p.c. Deb. ... ... | 97— 99 | +½ |

a The quotation is per £1 of Stock.
* Ex. div. ‡ For year.

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**Advertisement Index, see p. 254.**


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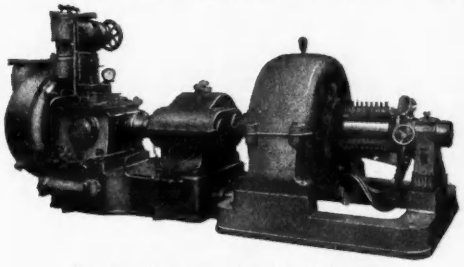

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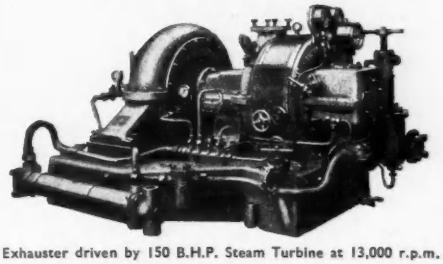

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